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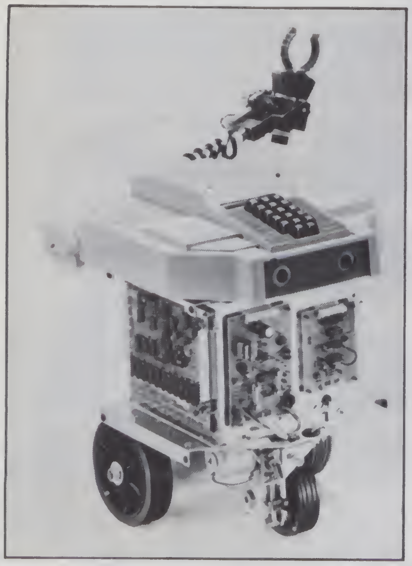
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PUBLISHER'S REMARKS

By
Wayne Green

Where to Put Your Money Down

Where to Invest?

With the desktop computer field in such a lovely growth mode, obviously some firms are going to do very well, making the investors rich. Desktop computers can be a golden investment, if you know where to place your bets.

Too little homework is being done before the bets are being placed, so we've seen a wide variety of losers already, and will see a lot more in the next couple of years.

With increasing frequency I'm getting calls from some of the larger investment firms asking for my opinion on other firms, which apparently have approached them with the idea of going public. I have a fair idea of what is going on in the industry, or at least know who to call to find out if I don't know. This is a resource that isn't ordinarily available, so what is the average investor, looking for that vein of gold, going to do?

With over 300 different manufacturers of desktop computers, obviously there is going to be some fallout. Despite the enormous growth of the industry—and the expected growth—we're going to see about 90 percent (or more) of these firms biting the dust. You know, probably the best rule of thumb for investing in desktop computing firms is to blindly sell every one of them short as soon as they bring out a stock offering, then sit back and get as rich as Croesus.

Well, obviously I have some better advice than that, or I wouldn't have bothered you with this. After all, the more money you can make investing in the winners, the more computer equipment you will be buying and, I hope, the happier our advertisers will be. Yes, there are some ways for you to figure out who is and who is not going to be a winner. That's the good news. The bad news is that if I knew for sure, I'd be betting my money on some of 'em myself. As it is, I think my own micro-empire is my best investment bet. After all, where else can I double or better my money every year, without fail?

Basic Needs

OK, until someone comes along and starts doing your research for you, all I can do is give you some basics of what to look for in a new firm that is going public. I'll also try to explain the reasoning behind the rules of thumb.

For instance, I hope it seems logical to you that the firm with the more efficient method of distribution will have an edge. Each firm will make every effort to get the cost of manufacture of the system down as much as possible, keeping an eye on quality and features, so one of the variables that affects the cost to the customer is the cost of distribution.

You may assume that each manufacturer will be smart enough to bring in management people with considerable experience in the desktop field so he will have an edge. You would be incorrect. If you think that even a firm about to gamble tens to hundreds of millions of dollars will get some advice from an experienced consultant in the field, you would probably miss your bet. I've watched too many new firms go merrily into the market with almost no expertise in what they are about to do, and disappear in a short while, often ending up as a new division of a more experienced firm.

One of the more serious hurdles for many firms has been a lack of understanding of the difference in marketing between minicomputers and microcomputers. For some reason, the devastating lessons learned by the mainframe industry's designers when they ignored minis ten years ago has been lost to the present generation of smugly assured captains, bent unintentionally on steering their firms into bankruptcy.

The minicomputer manufacturers developed the following system for getting their product out to the users. Many (most) of the customers had to set up data processing departments. The equipment and software were evaluated by data processing professionals, the software was written or modified by a systems house, and then the lab—complete with air conditioning, humidity control, antistatic

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carpets and the white coats—went into action. This is not a valid way of selling desktop computers.

On a $100,000 and up sale this is a reasonable way to handle the situation, which is why it developed that way. But when we're looking at $1000 to $10,000 or so systems, that approach is crazy. The marketing department, which sets up to deal with systems houses, selling to OEMs and so on, is geared to a fading world. Most of the sales of desktop computers are through computer stores. The sales of the low-end hobby and game systems are through discount stores.

Remember that there are more than 300 firms making desktop computer systems, so price is going to have some effect on sales. The firm that sells directly to dealers is going to be able to have a slightly lower price than the one that sells through a distributor, where around 10 percent has to be added for that service.

Now you know a couple of questions to ask. You want to know how the firms you are looking into sell their product. Are they geared for the minicomputer type of sales via OEMs and systems houses? Are they selling through a distributor instead of directly to the computer store?

Next you want to see about the product itself. Get in touch with the firm and ask about its dealers. How many have they? Where?

Then hie yourself to a nearby dealer and start your real research. You want to look over the computer and see if the salesman understands it, is enthusiastic about it, can point to a number of local users who are happy with this product, and is able to put on a persuasive demonstration.

Next you want to take a very critical look at the instructions that come with it. Are they really simple, or are they more likely to be classified as documentation? You know as well as I that most of the new customers for desktop computers need all of the help they can get from instructions. Manuals that come in a three-ring binder and are three inches thick are more intimidating than helpful.

I've tried a couple of the better-advertised portable computers in the last few weeks, only to be reduced to a frustrated and bitter old man, unable to get anything intelligent to happen. One system, promoted heavily for its built-in word processor, came with no useful instructions on how to get a printer to work with it. After totally exhausting my own patience, I called in my top hardware expert and turned him loose on the confounded thing. He finally gave up and called the factory. It was Friday afternoon, so no one was there for the rest of the weekend.

Another hint at the probability of survival of a firm can be found in the quality of its sales literature. The first thing you want to look for is simple: can you understand it? Does the literature go into the reasons why the computer can help you in your businesses, or is it giving you a big story on how great the firm is? Oddly enough, a good deal of what is being put out for sales literature is more of an ego trip for the management than anything of value for the prospective customer. The same, sadly, goes for a surprising amount of the magazine ads.

Just because a firm deals directly with dealers (thus keeping the customer costs down), is supported by a large number of enthusiastic dealers and has great sales literature and instructions is still not enough to guarantee survival. Remember the 300! Remember the 90 percent or better attrition which has to come. No, there are still some other key factors that are going to determine the winners and losers. Let's look at the basics of this situation.

The computer system buyer should look first for four main factors that must be present if a system is going to succeed for him. A weakness in any one of these four major support divisions means a weak product. And, just as a computer buyer should look for these four factors, so should someone interested in buying the stock of a firm or making any other major investment in it.

1. *Equipment*. You have to find out if it is adequate. Oddly enough, the equipment doesn't have to be much more than adequate, as Adam Osborne is so fond of telling us, pointing out IBM as proof. It's true, even though some of the electronic geniuses of the business seem to get carried away with this or that amazing new development. Well, perhaps Adam pushed the adequacy excuse a little hard with the disk limitations of his first computer, but the two new ones he's releasing seem to take care of that.

2. *Software*. In general you'll find that the amount of software available for a system is parallel to the number of systems that have been sold. Yes, this is a rotten problem for a new system that is not totally compatible with a major make of computer. Sorry about that, but even though some particular brand of computer may do just what you want, if you are going to bet some bucks on a stock, you want to go with the system that has a whole lot of software, because that is going to meet the needs of more people.

3. *Service*. This criterion may even be number one in importance. Computers break. Firms that are set up with a poor service system are not going to be as successful as those who keep the computers running with a minimum of hassle. And I could devote a whole magazine to stories of service disasters, arrogances, delays, snafus and incompetencies.

4. *Information support*. Yep, it's a conflict of interest to talk about this, but you just think about it. Without a dedicated magazine, the computer users are not going to have a convenient way of swapping information. And I'm not talking about a manufacturer-published whitewash magazine, but one in which an independent publisher lets readers lay their gripes, compliments and discoveries on the line. One in which small firms with accessories, information and programs can advertise and reach their target inexpensively. Not even the largest manufacturer can manage the needed support of his computer if he is going to keep up with technology.

Radio Shack Model 100. Time to buy Tandy stock again?

Now, when you add all of these up, I think you'll get my message. I think you'll see why I haven't rushed out to put money down on new stock issues in our wonderfully growing field. With over 90 percent of the sales volume in the micro field in the hands of a very few firms, the rest of the 300 are going to have a difficult time. Gone are the days when a new outfit can come in with five or ten million dollars and expect to last. Oh, I have the conceit to think I could probably engineer a newcomer into the top ten for around $10M, but remember that I've been around the industry since it had only one firm making computers.

What about the firms making the low-end systems? These are gigantic firms, so are they good investment bets? Ordinarily, I might agree that this is a good place to clean up, except that the big firms are beating each other's brains out with price cutting, and it is doubtful if anyone is making much of a killing. A lot of wounding, perhaps.

The new Radio Shack Model 100 may turn things around for Tandy. If they don't sell $100M of those in the next year I miss my bet. Time to buy Tandy stock again perhaps?

Apple? Well, let's just sit tight and see the Mackintosh. The Lisa seems to be out on the ice as far as customers are concerned. The IIe is doing nicely, picking up right where the II left off. But any real spurt is going to take something new, something good, something not too high-priced.

Instead of pounding your money down a microcomputer hole, how about taking it and getting a small business of your own started? Each new popular machine offers almost unlimited opportunities for support products. Let the big boys bet their millions on computers. You bet on programs, memory expansion, graphics boards, better keyboards, uninterruptible power supplies, things like that.

Any arguments?□

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WHAT'S NEW, BIG BLUE?

By Thomas V. Bonoma

Watching the Software Flow

PC Packages For Beginners And Pros

Getting Personal

I've been rereading previous columns, which is a dangerous thing to do, because this month I've got to make good on some of my promises to you.

After taking care of some "old business" (including a correction to PERTCHT.BAS, suggestions on the ideal PC system and a press release or two), we'll review dBase II. Then we'll take a drink from the PC software torrent, sampling the financial/spreadsheet, games and utility streams.

For you color adapter users, I've got a program I think you'll like; it can teach some of the finer points of BasicA's Circle and Paint commands. But first we'll look at a trio of top-rate software programs.

An Unworldly Software Mix

The Instructor, Chartman and Concurrent CP/M-86 make up an unworldly software mix, perhaps, but they share one trait—excellence.

The Instructor

The Instructor (Individual Software, 24 Spinnaker Place, Redwood City, CA 94065; $44.95) addresses what *Time* calls "terminal phobia." It teaches keyboard operation (down to and including the operation of each key), use of menus and, generally, how *not* to be afraid of the machine.

If you're reading this, you may not need or want The Instructor—it *finishes* with directions on the use of menus. But perhaps you know someone who's afraid of the PC, who really needs to start at the beginning—someone who needs to play "Cursor Man" to understand the arrow keys. This finely coded, superbly documented software is the perfect learning aid for beginners.

Address correspondence toThomas V. Bonoma, 45 Drum Hill Road, Concord, MA 01742.

Chartman

I told you last month that graphics on the PC was starting to bloom; now we've got more evidence.

Chartman (Graphic Software, Inc,. PO Box 367, Kenmore Station, Boston, MA 02215) comes in three versions: Chartman I ($380), which includes up to 20 different chart types, works with a monochrome display, an Epson MX-80 or MX-100 and an HP7470A Plotter; Chartman II ($425), which does everything Chartman I does, but in color; and Chartman III ($199), which has all the basic features of Chartman I, but fewer chart types. I tested Chartman II; you won't be disappointed with it.

There are three Chartman disks, and they cover four types of graphing needs.

Disk 1 is for bar charts; it handles stacked, multiple or perspective bars in six different formats, including a 3-D one.

Disk 2 is for pie charts; it permits pies of up to 20 slices, in percents or values, one or two on a page, in two or three dimensions and with or without an accompanying bar chart. Unbelievable!

Disk 3 is for line charts and text charts; the latter is a feature I've found missing in all but dedicated plotting software. It allows you to type overhead transparencies, put them out on the plotter and have presentation-quality graphics.

All charts are entered by using a forms-driven editor, which guides you step-by-step through the selection of titles, sizes, colors and data limits, and through the inputting of data. The editor, the worst feature of this excellent system, is a little slow, but you really aren't inputting all that much information, so it's tolerable.

The graphics are generated quickly, and they're savable in disk files and recallable at will. They can be plotted to the medium-resolution color screen, dumped to the Epson or IDS Prism Color Printer or output to an HP7470A plotter or an IBM eight-pen plotter.

The system works flawlessly and produces presentation-quality graphics—especially text charts—quickly and easily. Graphic Software even has included input forms requesting graphics that you may copy, so that others can ask for graphs in a manner the Chartman operator can execute.

The manual is a little thin in places, but not much of a manual is needed because the system is well-documented and makes full use of the PC function keys.

You should know about a few restrictions before you buy Chartman II, however. First, Chartman is copy-protected. Also, the HP7470A must be connected to your PC via a serial card; the Epson and/or Prism, if it is used, must be connected with parallel cables. Why Chartman went to such lengths to make such an outstanding system, but didn't make it possible for each user to configure it to his unique setup, is beyond me.

Outside of this glitch and my complaint about the graph-entry editor, Chartman II is near-perfect.

Concurrent CP/M-86

Concurrent CP/M-86 (Digital Research, PO Box 579, 160 Central Ave., Pacific Grove, CA 93950) is Digital Research's latest operating system innovation for the PC.

What does it do? Well, if you want to edit a paper or two and print a third while viewing a fourth, Concurrent CP/M takes care of the details and lets you switch from one task to another at the push of a key. Print spooling (printing one document while editing another) is now routine, and you'll waste no more time waiting for the PC . . . it can do it all at once.

To use this fantastic operating system, you'll need 256K of memory, although CCP/M supports up to 544K. Beyond that, anything's fair game. CCP/M will handle either or both monitors, printers and a host of other peripherals.

Essentially, CCP/M does its work by creating up to four "virtual consoles" on your machine, and letting you switch between them at will. As well as having all of the commands familiar to those of us who grew up with CP/M machines (e.g., PIP and ED), CCP/M has reliable documentation.

Now for Concurrent CP/M-86

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VEDIT supports all of the new CRT terminals, video boards and 8080, Z80 and 8086 computers. We have been consistently first to support new computers - first for CP/M-86, first for MSDOS. And we will support you with any technical assistance you may need.

For the full story, purchase VEDIT risk free. Evaluate the 125 page manual and if you are not satisfied, return the package (disk unopened) for a courteous refund.

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COMPARE VEDIT

Feature	VEDIT	WordMaster	WordStar
True Full Screen Editing	Yes	Yes	Yes
Edit files one disk in length	Yes	Yes	Yes
Compact and fast	Yes	Yes	No
Display of line and column #	Yes	No	Yes
Set/Goto text markers	Yes	No	Yes
'Undo' key to restore line	Yes	No	No
Automatic Indent/Undent	Yes	No	No
Adjustable tab positions	Yes	No	Yes
Repeat function key	Yes	Yes	No
Text move and copy	Yes	Yes	Yes
Scratchpad buffers	10	Only 1	No
Load/Save buffers on disk	Yes	No	No
Flexible command mode	Yes	Yes	No
Multiple command macros	Yes	No	No
Directory display	Yes	No	Yes
Edit additional (small) files simultaneously	Yes	No	No
Insert another disk file	Yes	Yes	Yes
Unlimited file handling	Yes	No	No
Automatic disk buffering	Yes	Yes	Yes
Recovery from 'Full Disk'	Yes	No	Some
Change disks while editing	Yes	No	No
Startup command file	Yes	No	No
Program CRT function keys	Yes	No	No
Word Wrap and reformatting	Yes	No	Yes
Printing	Simple	No	Extensive
Print formatting	No	No	Yes
Menu driven installation	Yes	No	Yes
Support newest CRT terminals	Yes	No	No
Support smart CRT functions	Yes	No	Some
Customizable keyboard layout	Yes	No	No
Available for CP/M-86	Since 1981	?	?
Available for MSDOS	Since 1981	?	Yes

Please specify your microcomputer, video board or the CRT terminal version, 8080, Z80, or 8086 code, operating system and disk format.

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Digital Research designers seem to have heard all of us who tore out our hair over the CP/M technical manuals; they're really making an effort to write in English.

The liability with this system? Well, you've probably guessed . . . the lack of software to run under it. By pricing its PC-DOS so low, IBM has virtually locked Digital Research out of the PC market up until now. But "regular CP/M" for your machine will have been slashed drastically in price by the time you read this, and software to run under your shiny CCP/M may not be so long in coming.

Old Business

A reader from New Hampshire has written and called to tell me about a problem he had with PERTCHT.BAS.

It appears that, when run with a monochrome adapter on a basic 64K system, you can run out of memory when running this program. The fix? Redimension the three arrays in line 120 of the program to something smaller than the expansive 500 I used, like 200.

Perfect PC Setup?

Dafydd Dyar of Guam is an electronics-trained PC-lover who has been spec'ing his ideal system for several months.

Because shoppers usually are up to date on what is available, and because of Dyar's abilities to evaluate technical data, I asked him to make some suggestions for beginning and advanced PC systems. His suggestions are contained in Fig. 1.

I agree with most of Dyar's recommendations, but with these additions: an advanced system should also contain an HP7470A plotter and a 15M (minimum) hard disk. What do you think? Write in and help spec the "perfect" systems for beginners and advanced PC users. (Note: the XT hadn't been released yet when Dyar made his choices—but he'd still get the PC.)

New on the Market

IBM announced two new programs for the PC. The IBM Personal Computer Home Budget program, which sells for $60, is claimed to be a full-fledged home ledger program requiring no accounting experience from users. More exciting, perhaps, is the Basic Primer, an on-screen educational workbook that teaches Basic programming. Again, the price is $60; both programs require an 80-column display.

Rumor has it that Stoneware's DB Master, a program some of us know from the Apple, will be available in the first quarter of 1983. The program, which will retail for $499, requires 192K of memory and two double-sided disk drives. It supposedly has been completely rewritten in a more powerful PC version that takes advantage of the capabilities of our machines. We'll see . . .

dBase II Review

More than ten companies are making their living from selling "add-ons" to one software program. Seminars are being conducted all over the country in learning it. One vendor has just released a graphics package designed for it, and another's software (1-2-3) supports its file formats. Its manual, even the tutorial, quickly outstrips the abilities of even the most confirmed hacker to understand the intricacies of its programming language within a programming language, yet its simpler commands can be operated by a child.

What is it? Why, it's dBase II (Ashton-Tate, 9929 West Jefferson Blvd., Culver City, CA 90230; $695 at full retail, but significantly cheaper from discounters).

dBase comes with a restricted version of itself, which you can use to try the system out after you've made the purchase, but before you open the "real" software package. This way, if you don't like it, you can return it for full credit—an outstanding idea.

dBase II features an acceptable tutorial (good at the beginning, overcomplicated at the end), a solid reference manual, a disk full of sample programs that are used to control data entry, output and reporting (but don't have to be), and even a sheet of errors found in the latest version, 2.3D. (Don't buy earlier versions, like 2.3, for the PC . . . they're as buggy as a flophouse bed!)

dBase II is written in assembly language, and, as such, is fast, uncomplaining and about as flexible as any program could be.

To use a database, for instance, you simply type "Use Software Index NameSoft," which tells dBase you want to use database SOFTWARE.DBF indexed by name of software package (full indexing is supported, although only one index can be in use in this version at one time).

To add records, you type Append; to edit them, type Edit; to print a report of what is out there, type Report. And, to find a package named "Galactic Encounters," type Find Galactic Encounters. If you know only that its name begins with "P" and the vendor is SuperSoft, then type Display For 'P'$Name .And. Vendor = 'SuperSoft.'

The real power of dBase is found in its "program command language," where you write files (with dBase's included program editor or any other editor) to the disk of type *.PRG, which can then be run to "automate" your application.

Flaws in the system? Well, there are a few, but Ashton-Tate at least tells us about them. A set of technical notes is included with problems to all of the other revisions (2.3, 2.3A, 2.3B), and A-T puts its phone number visibly on the documentation.

Also included is a technical note describing how to patch dBase II if you want to use it under DOS 1.0 (it runs under 1.1). It's available as well for CP/M-86 (as long as you have 128K) and a printer.

The real flaw with dBase II is the same flaw that WordStar has. It's so complete and so complicated that it's intimidating. Hence, the seminars and add-ons.

If you'll work with it, though, you'll never use anything else. Plan on a couple of days practice before you can use dBase II interactively, and plan on a couple of weeks or a month before you can *really* make it bark.

Ideal PC Systems for Beginning and Advanced Users

(Courtesy of Dafyyd Dyar)

Beginner's System
(Approximate cost: $3500)

The minimal system would have 64K on the System Board, at least one disk drive 320K and a color and graphics adapter connected to a PGS HX-12 monitor ($795).

It would have IBM's *Technical Reference Manual*—even if I didn't understand it all (I can always learn). I would cram on PC Basic and BasicA until I was able to use the Basic Compiler ($200) and/or Macro-Assembler to turn my slow Basic programs into fast-running assembly routines. I'd probably get FriendlyWare's PC Introductory Set ($50), and also the Norton Utilities ($80), which has disk-copy and recovery routines, along with other useful programs.

Advanced System
(Approximate cost: $10,000)

The advanced system would have 256K on the System Board, along with the 8087 coprocessor. It would have a color/graphics board, probably the Plantronics Colorplus brand (about $400), the AST Research Combo + + + board with 256K RAM, a clock-calendar, parallel port and RS-232 serial port ($995), a game control adapter and PGS HX-12 monitor ($795). The printer would be a fully loaded IDS Prism with single-sheet feed, dot graphics and Sprint (about $2000).

It would have two 320K disk drives and a Genie 5 + 5 removable cartridge 5M hard disk ($3995). I would use the Hayes 1200 Smartmodem and Votrax speech synthesizer.

For graphics, I'd have the Micro Control Systems Space Table ($1195), the XEC Mousetrak "mouse," and a Symtec light pen ($150). And, as long as we're dreaming, we'll put as much as possible into a CompuCart or MicroKart cabinet ($450 to $600).

Fig. 1. IBM PC all-star system setup, as sent in by a reader.

Word Processing

We've got two more word processors to review and a story to tell.

Designer Software (3400 Montrose, Suite 718, Houston, TX 77006) has made its Palantir word processing system ($400) available for the PC. The system has been rewritten to run on the IBM's 16-bit processor. Text is formatted on the screen as it will appear on the printer, boldface characters are highlighted, underlines are underlined and everything is done well.

Palantir has a good menu-choice system, a built-in mail-merge facility and onboard macro definition (you can define frequently-used phrases with a single key).

Also, Palantir allows specification of the printer to be used at printing time. For example, you can have both an Epson and a NEC hooked up to your machine, and output drafts to the Epson and finished copy to the NEC.

Documentation provided with Palantir is generally excellent, and the system comes with on-line help and tutorial files as well. If that isn't enough, you can use either the color monitor (so you can have boldface in red, for example) or monochrome for your word processing needs.

So why aren't I raving about this word processor? Because it didn't work, that's why! It wouldn't read or write files from the disk and it would sometimes refuse to exit to DOS when asked (the system would hang). And when an error was committed, prompts would be put on the screen only long enough for Superman to read them.

I called Designer about these "little problems," and it turns out that all disks shipped before January 10, 1983 (read the last three digits on your serial number) had a flaw in the Install program. A corrected disk was sent to me, and it worked flawlessly.

In addition, there's a patch to fix earlier disks; contact Palantir if you need it. You'll want to look at the revised system; add a spelling checker (I recommend Proofreader) and you'll have a solid and complete word processing system.

Another piece of software with problems in the version I tested is SuperWriter, $295 from Sorcim (2310 Lundy Ave., San Jose, CA 95131). Spellguard Spelling Checker is $195.

If you're old enough to remember Magic Wand, then you've met SuperWriter. Magic Wand was my first word processor—and I'm still in love with it. Sorcim took out all the objectionable features of Magic Wand, improved on its filing/manuscript archiving capabilities and wrote one of the best documentation manuals I've seen.

Magic Wand always has had one of the best "include" and mail-merge-type systems available. The same is true of SuperWriter, except that it's about one and a half times as good as Magic Wand ever was. And, Sorcim's adaptation of Super Spellguard, a dynamite spelling program, is true to the original.

So why am I complaining? Because revision 1.10 of SuperWriter, which I tested, has an annoying habit. As the user fills up the screen with text, the program gets progressively slower in its ability to keep up with the typist. At the top of the screen, all's well; toward the middle, it's touch-and-go, and by the time I hit the bottom of the screen, I could outrun SW by a line and a little without really trying.

I don't know if you've ever tried "time-delay typing," but it's *strange*. I talked to the product manager in charge of development on SW, and he assured me that this little glitch will be out of the software by the time you see it. If they get it out, it will have a high recommendation from me. If not, it's junk. Get a demonstration before you buy.

Financial and Spreadsheets

The Optimizer, from SuperSoft (PO Box 1628, Champaign, IL 61820; $200) is a linear programming problem-solver. It works flawlessly, and would be an excellent buy if it were around $50. However, at roughly a penny a byte, it's not a good buy.

The program is 13,000-odd bytes of unlocked Basic code, with bare-bone screen displays, little or no input error-checking and no disk-based tutorial or sample files. The manual is well-done and has an extensive section on how to conceptualize problems amenable to linear programming solutions. (The biggest problem in using linear programs lies in conceptualizing the problem correctly—the math is largely programmable calculator variety).

I like the program, and when I checked other financial/forecasting packages, I found none that made this technique available in its generalized form, although many (for example, Eagle's Money Decisions) adapt it for specific problems. However, SuperSoft might want to take a hard look at its pricing policies.

LogiCalc ($190) and ProCalc ($350) are two spreadsheet/financial modeling entries from Software Products International, Ltd. (10343 Roselle St., San Diego, CA 92121).

LogiCalc is the "little brother" of the offerings; it offers only a narrow range of built-in functions (sum, average, maximum, minimum and count) but makes up for it with a full linear regression routine. ProCalc is a full-bore financial modeler; it can handle annuities, present and future value problems, depreciation and linear regression.

Both programs are written in UCSD Pascal, which means they can take advantage of memories greater than 128K (the minimum necessary for either program). Both supply an on-board text editor as an extra.

The documentation, though turgid, is sound, and includes a tutorial, sample applications and a reference manual. Another section of the manual is devoted to Pascal utilities (such as formatting). In addition, both programs support dependent spreadsheets; that is, you can incorporate values from one spreadsheet into the current one as you like.

The real beauty of both LogiCalc and ProCalc is that they are completely integrated with SPI's DBMS program, LogiQuest, and also with its full line of accounts receivable, accounts payable, order entry and other business programs. It's nice to see integration and attention to completeness for a change.

If it meets your needs, ProCalc is a reasonable and significantly cheaper competitor to Ferox's Micro-DSS/Finance, reviewed here in an earlier column.

Champion Spreadsheet

For unintegrated applications and as a stand-alone spreadsheet, the winner and still "champeen" is, without a doubt, Multiplan (Microsoft Corp., 10700 Northup Way, Bellevue, WA 98004; $275).

Ever wish you could name an area of your spreadsheet (say, "Miscellaneous"), and then just refer to the name in future calculations (for example, Minimum [Miscellaneous], where Miscellaneous is 12 cells of expenses from January to December)? You can with Multiplan.

Ever want to sort entries, either alphabetically or numerically, after you had entered them? Want the formulae and all calculations moved automatically, too? You'll get it here.

Want a "percentage" column, with percent signs, dollar columns with dollar signs and two decimals, and negative numbers in parentheses—like you're used to seeing? Done.

There's more. Multiplan "knows" you and I are too dumb to remember what's on the disk, or even what we've just named an area of the worksheet, so there's a provision to step through names and to see files.

How about on-line help? Multiplan's got it, and it's nicely done.

Multiplan also allows you to frame one of your multiple-screen "windows" and display only this part in inverse video. If you have a color monitor, you choose colors for the frame and numbers and background for each window as well.

In addition, you can create "dependent" sheets for your main model, so that you know, for example, what that cryptic $1,112.39 in the "Other" category was made up of for March. Formulae or numbers, a flexible print routine, classy "glass box" packaging and awesome documentation . . . plus the ability to convert VisiCalc files over to MP! Now do you see why I gave MP a "Software Award" last month?

Switching gears for a moment—even though it will be late for tax time when you see this—Tax Cut (United Micro Systems, PO Box 3035, 100 N. Stone,

#1100, Tucson, AZ 85702) is a nice set of programs for the PC.

Put simply, Tax Cut will prepare your taxes for you. It has multiyear capabilities, it does income averaging and, when you have to enter a number that is used on several tax forms, Tax Cut automatically carries the number through all relevant forms.

The program, supplied on three disks, has a special disk for depreciation problems, and we couldn't find anything that it couldn't cope with, or that it left out or got wrong when we did a test run of our own complicated tax situation.

One complaint—my copy, shipped to me in January, didn't have the programs needed to print out the tax returns. This is because, a letter stated, the new forms weren't released until November . . . United Micro says they'll forward the forms to all Tax Cut owners in February. I'll let you know, but keep your eye on this for 1984's return.

Games

Unless you tell me to do otherwise via the mail, I'll make a real effort to keep you aware of new PC games, but I'll keep the reviews shorter than those for other software. Part of the reason is my mail, which is distinctly biased toward "working" applications, such as word processing and DBMS programs. Part of it is my own biases. What do you think?

Pac-Man Types

The Chrome Ranger, from Omniware (3153 S. Boston Court, Denver, CO 80231; $29.95), is one of the better games of the Pac-Man genre. It features selectable skill levels, high score retention, changing mazes and user-definable setups for any display adapter/monitor combination. You can use either a keyboard or joystick; the program is particularly clever with interfacing to a joystick, since it calibrates itself without aid from the user.

If you're perverse or perverted, try Floppy Frenzy (Windmill Software, 1058 Joan Drive, Burlington, Ontario, Canada; $39.95). Your player is a disk, and the "Pac-men" are magnets and (horrors!) dust balls.

You'll need color graphics for Floppy Frenzy—and wait until you see what happens when your disk dies! Yes, Virginia, there is an electronic heaven.

New from Funtastic (5-12 Wilde Ave., Drexel Hill, PA 19026; $38.95) is Snack Attack II, which has gumdrops for dots, three mazes, doorways, six levels of play, full color (only), keyboard or joystick, sound toggle and a sound implementation.

Shoot/Space Games

I used to, in the old days, have a TRS-80 Model I (Level II). It had no printer, it had no disk, it had no color and it very nearly had no memory. Nonetheless, I loved it, and I wish I had it and its balky tape recorder back.

On that machine was a version of Star Trek that was absolutely great—especially for 1978. I've been looking for something like that for five years, and I've finally found it.

Video Trek 88, from Windmill Software ($34.95), is a real-time implementation of Star Trek, and it's suitable for the monochrome or color adapter (it's better in monochrome).

From the Cloaking Device to the shudders of your Main Screens when you're hit by phaser fire, it's the best Star Trek implementation I've seen.

Another version of Star Trek is Galactic Encounters, from Micro Productions (PO Box 147, Georgetown, TX 78626). This version of Star Trek gives you extras that Video Trek doesn't—hyperdrive, a "Z-ray," the ability to dock on planets and so on. The game also makes use of the PC function keys.

Galactic Encounters is not in real-time—a critical fault, in my opinion—and it doesn't do nearly as good a job with screens, sound or action as does Video Trek. Don't get me wrong—it's a competent game; it's just not what I had on the TRS-80.

Another competent game is Cosmic Crusader ($38.95), also from Funtastic. It's about the toughest and best-animated version of Space Invaders I've ever seen. Cosmic Crusader features nine levels of play, full color, joystick or keyboard and sound toggle, and it requires color.

Other Games

I can almost hear you now . . . a *quote* game? Yawn. Actually, though, Quotrix (Insoft, 10175 S.W. Barbur Blvd., Suite 202B, Portland, OR 97219; $34.95) isn't boring at all.

To figure out each word in a quote, you must pile possible letters on a camel's back (without breaking it), solve trivia questions, do crossword puzzles or unscramble words. In other words, you have to solve puzzles to solve the puzzle. Quotrix requires 64K, one disk and the monochrome or color adapter.

Finally, Armonk Corp. (610 Newport Center Drive, Newport Beach, CA 92660) has released a game that simulates a dash up the corporate ladder at "MMC Corp." In Executive Suite ($39.95), you interview with the personnel office, start in a lowly job and try to work your way to the chairman's office.

On the way, you'll have to deal with corporate espionage, marketing crises, company coups and your boss's drunken

Program listing. The author's Circsav.bas program.

```
     Time:  10:12:51                        Date:  02-08-1983

                              PROGRAM CIRCSAV.BAS

                               Thomas V. Bonoma

                    Teaches some things about BASICA graphics commands.

5    ' References in brackets [ ] are to IBM's Basic Reference Manual
10   '   PROGRAM :  CIRCSAV.BAS
20   '   Functon :  Generate, save, recall circles and ellipses
30   ' *** For use with color graphics adapter board only ***
40   ' Author:  T. Bonoma                      Date:  04/08/82          Version: 1.1
50   CLEAR , , 8000 '     Set aside 8K bytes for stack [4-38]...a precaution
65 GOSUB 7000 'set things up so that F1 exits program any time...
70   GOSUB 160  'Give instructions
75   ' Routine to choose colors
80   SCREEN 1,0 'Medium resolution graphics, colors enabled [4-222]
85   ' Set the background and color of text [4-47]
90 CLS: PRINT "Pick a color (0-15) for background  "
100 INPUT; "and a palette (0 or 1) to use";BKGD, PAL
105 '  [4-105], [4-106]
120 IF (BKGD <0) OR (BKGD>15) THEN 150 ELSE IF (PAL<0) OR (PAL>3) THEN 150
125 ' [4-100]
140 COLOR BKGD, PAL: PRINT "Color's all set...": FOR I=1 TO 600: NEXT I: GOTO 40
0
150 GOTO 90 'AN INSURANCE LINE IN CASE THE PROGRAM RUNS INTO THIS...
160 CLS: SCREEN 0,0,0: WIDTH 80 : IF LEFT$(TIME$,2)="00" THEN GOSUB 6000
161 LOCATE 1,1: COLOR 8,0,0: PRINT TIME$;:COLOR 7,0,0
162 COLOR 28, 0,0: PRINT TAB(35); "CIRCLES":COLOR 7,0,0
165 PRINT:PRINT
170 PRINT "The ";:COLOR 12,0,0:PRINT "CIRCLES";:COLOR 7,0,0
175 PRINT "command allows 5 parameters to be input: "
180 PRINT "            1.  The center (x is from left edge, y is from top edge);"
190 PRINT "            2.  The radius (in dots);"
200 PRINT "            3.  The color (1-3: 0 is invisible);"
210 PRINT "            4.  The start and end angles;"
220 PRINT "            5.  The 'aspect' of the figure."
230 COLOR 8,12,0:PRINT:PRINT STRING$(70,127):COLOR 7,0,0 'a house figure
235 PRINT
240 COLOR 2,0,0: PRINT "More specifically, 'aspect' is the ratio of the x to the
 y radius."
250 PRINT "If < 1, it gives a flat ellipse.  If >1, a squashed one."
260 PRINT:COLOR 10,0,0:PRINT"And, start & end are the beginning and ending angle
s from -2 pi to 2 pi."
270 PRINT "If negative, they give a section of a circle.  We won't be using the"
```

More

wife, who invites you in "for a drink." If you work in business or know business, you'll absolutely love Executive Suite.

Utilities and Hardware

From Blue Water Systems (PO Box 1877, Oceanside, CA 92054; $39.95) comes Expandson, an Epson/Graftrax Plus or Okidata 84 ($59.95 for this version) print utility.

Expandson works as a postprocessor for WordStar files. The user can employ all of Graftrax's upgraded features, such as italics and expanded/compressed/emphasized text.

Through the use of embedded commands in the WordStar file, Expandson allows line graphics for chart-drawing, special characters, superscripting and subscripting. An uncompiled version also works as a stand-alone Basic print utility.

I found Expandson to be a reliable and useful print utility as a stand-alone. With WordStar, however, it has shortcomings. You can't run the program from within WordStar . . . you must call it from DOS. It's tedious to insert the special "$>" commands and the like to generate line graphics, and the WordStar file must be printed first to disk by WordStar, then to the printer by Expandson.

Customize Your Keyboard

Prokey ($75, ProSoftware, 4710 University Way N.E., Suite 601, Seattle, WA 98105) "lies under" any application (such as Wordstar, TIM or Multiplan) and lets you customize your keyboard at will to make some sense of all the weird and multiple keystrokes each program demands. It even works with DOS commands.

With your applications programs, Prokey makes it easy to redefine the keyboard to anything that suits you, and to make just one key, for example, stand for "address this envelope with the following name, etc." in your word processor. And Prokey doesn't hurt DOS in any way.

High-Performance Hardware

On the hardware front, FTG Data Systems (10801 Dale St., Suite M2, PO Box 615, Stanton, CA 90680) offers the FT-156D High-Performance Light Pen ($159.95) and Demo/Games Software Package ($39.95) for the IBM PC.

The light pen is a quality piece of hardware that can be installed easily, has a telephone-like plug and jack outside the computer so you can disconnect quickly, and works flawlessly (but *only* with the color adapter/monitor—the monochrome uses a nonstandard phosphor that won't register).

The software demo pack is not the usual piece of junk; it's a series of innovative, useful and complex programs (including a Light Pen Life) that makes up a fine tutorial. FTG even supplies a

Listing continued.

```
275 PRINT "start and end angles in this program"
278 COLOR 9,0,0:PRINT: PRINT"You'll also get a chance to PAINT what you make, an
d to save it.":COLOR 7,0,0
280 PRINT: PRINT:  PRINT "Hit any key to start, F1 key any time to end program,
F2 if your first time";
285 Y$=INKEY$: IF Y$="" THEN 285 ELSE 300
300 RETURN
400 ' Try out Circles and Ellipses
405 LOCATE 1,1: PRINT STRING$(40,32);STRING$(40,32);STRING$(40,32)'3 lines blank

425 LOCATE 1,1:INPUT "Xctr (50-250), Yctr (50-150)",XCTR,YCTR
430 IF (XCTR<50) OR (XCTR>250) THEN 405 ELSE IF (YCTR<50) OR (YCTR>150) THEN 405
437 LOCATE 1,1:PRINT STRING$(40,32);STRING$(40,32);:LOCATE 1,1: INPUT "Now the r
adius (0-49) ",RADIUS
439 IF RADIUS<1 OR RADIUS>50 THEN 437
440 LOCATE 1,1:PRINT STRING$(40,32);:LOCATE 1,1:INPUT "And the color (0-3) ",HUE

450 IF HUE<0 OR HUE>3 THEN 440
482 LOCATE 1,1: PRINT STRING$(40,32);:LOCATE 1,1:INPUT "Finally, the aspect (.01
 to 6.0)  ",ASPECT
485 IF ASPECT <.01 OR ASPECT >5.99 THEN 482
490 CIRCLE (XCTR, YCTR),RADIUS,HUE,,, ASPECT
505 LOCATE 24,1: PRINT "Circle (";XCTR;",";YCTR;")";RADIUS;",";HUE;",";ASPECT;
```

More

Circle 33 on Reader Service card.

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In a recent review (*80 Micro*, September 1982) **Palantir** was compared to Select™ and Scripsit™ 2.0. It was not surprising (to us, anyway) that the reviewer found **Palantir** easiest to learn and to use. (Select was third.) But even we were surprisesd when he also rated our tutorial highest. We, too, had believed Select's ads about typing "T" for Teach™.

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machine-language light pen read routine, because it discovered bugs in IBM's own code.

The documentation, while collated backwards, was superb on both the hardware and software. Whether you need or will use a light pen is something else again, but if you're going to get one, I think this is it.

Spool/64 ($319 from Apparat, Inc., 4401 S. Tamarac Parkway, Denver, CO 80237) is a hardware print spooler with a 64K buffer that links the PC's parallel-port output with the Epson printer (or other parallel printer, if you buy a special cable not supplied).

I was able to install the spooler without removing the computer's cover; this significantly decreases the amount of time your PC will spend tied up during printing, because the spool buffer stores text to allow you to get on with other things.

The spooler has a simple set of software control codes to modify its operation from Basic, and a self-test mode as well. Source code is given for the Z-80 microprocessor's control program on the spooler—in case you wish to customize it.

The documentation, while adequate, was Xeroxed and not professionally produced. However, the hardware worked superbly and, like any good timesaver, you don't even know it's there.

One caution, however: All intelligent spoolers can interact negatively with printer control codes to give unexpected results. Spool/64 seems to have a particular dislike for graphics dumps.

Program: Circsav.bas

All that and a program too? Yup—although I'm feeling kind of humble these days. I just reviewed six (!) disks worth of software—available to you for the price of submitted programs—from the New York Personal Computer User's Club (write Joe Rigo, NYPC, 1385 York Ave., New York, NY 10021; $10 to join). This club has some outstanding user-submitted software you should get.

Still, I'm proud of this month's program, for I wrote it when I was learning to deal with BasicA in color. Circsav.bas will teach you about a single command, Circle. When you don't know what you're doing with a command, it's often a good idea to write a program. You'll learn quickly enough!

The program also will show you how to do color-adapter text-paging to give instructions, how to use the function-key "event-trapping" feature of BasicA and how to manipulate the on-board clock.

The program is especially well-documented; bracketed references are to IBM's Basic reference manual, in case you want to read more. Enjoy!

As usual, if you don't want to key it, send me a disk and $10 and I'll copy all the programs we've done since September of 1982 for you, including Circsav.bas.□

Listing continued.

```
507  FOR I= 1 TO 1000: NEXT I: LOCATE 24,1: PRINT STRING$(39,32);
510 LOCATE 1,1: PRINT "<A>NOTHER,<S>AVE/RECALL,<T>OP, <P>AINT"
530 Y$=INKEY$:IF Y$="" THEN 530
535 LOCATE 1,1: PRINT STRING$(39,32);
540 IF Y$="A" OR Y$="a" THEN CLS:GOTO 400
545 IF Y$="T" OR Y$="t" THEN 400
550 IF Y$="S" OR Y$="s" THEN 1000
555 IF Y$="P" OR Y$="p" THEN GOSUB 3000 ELSE 510
1000 'Save-a-color buffer routine [4-29]
1005 GOSUB 2000
1010 DEF SEG = &HB800
1015 LOCATE 1,1:PRINT STRING$(40,32);STRING$(40,32);STRING$(40,32);STRING$(40,32
);STRING$(40,32)
1017 REM THREE LINES OF SPACES TO CLEAR TEXT ON SCREEN
1020 BSAVE "B:PICTURE",0, &H4000 '[4-29]
1025 LOCATE 24,1: PRINT "Picture saved...                  " ;: FOR I=1 TO 500: NEXT
 I
1027 LOCATE 1,1: PRINT "<A>, <T>, <R>, <D>elete it";
1028 W$=INKEY$: IF W$="" THEN 1028
1029 LOCATE 24,1: PRINT "                                        ";
1030 IF W$="t" OR W$="T" THEN 400: ELSE IF W$="R" OR W$="r" THEN CLS: GOTO 1040
1035 IF W$="d" OR W$="D" THEN 4000:CLS:GOTO 510
1038 GOTO 1027
1039 RETURN
1040 ' RECALL IT
1050 DEF SEG = &HB800
1055 CLS'CLEAR THE SCREEN
1059 ON ERROR GOTO 8000
1060 BLOAD "B:PICTURE",0 '[4-27]
1061 ON ERROR GOTO 0
1065 LOCATE 1,1: PRINT"<A>, <T>, <R>, <D>";
1070 W$=INKEY$: IF W$="" THEN 1070
1080 IF W$="T" OR W$="t" THEN 400: ELSE IF W$="R" OR W$="r" THEN CLS: GOTO 1040
1090 IF W$="d" OR W$="D" THEN GOSUB 4000: CLS: GOTO 510
1100 GOTO 1070
1110 RETURN
2000 ' check it out
2010 LOCATE 1,1
2030 PRINT"Want to <S>ave, <R>ecall, or <E>xit the routine?"
2040 Z$=INKEY$: IF Z$="" THEN 2040
2045 LOCATE 1,1:PRINT STRING$(39,32);STRING$(39,32);
2050 Z$=LEFT$(Z$,1)
2060 IF Z$="s" OR Z$="S" THEN GOSUB 1010 ELSE IF Z$="r" OR Z$="R" THEN
      GOSUB 1040 ELSE GOTO 510
2070 GOTO 400
3000 'I painted it, painted every part, and though I'm  not an artist...
3002 LOCATE 1,1: PRINT STRING$(40,32);STRING$(40,32);STRING$(40,32);
3005 LOCATE 1,1: PRINT "Paint with what color (1,2, or 3)":INPUT INSIDE
3007 IF INSIDE <0 OR INSIDE >3 THEN 3005
3010 PAINT STEP (0,0), INSIDE, HUE
3015 LOCATE 24,1: PRINT STRING$(40,32);
3017 LOCATE 24,1: PRINT "PAINTed STEP (0,0), ";INSIDE;", ";HUE;
3019 FOR I= 1 TO 1000: NEXT I: LOCATE 24,1: PRINT STRING$(39,32);
3020 RETURN 510
4000 ' delete the file "B:PICTURE"
4010 KILL "B:PICTURE.BAS"
4015 CLS
4020 RETURN
5000 PRINT "ending...":FOR I=1 TO 700:NEXT I:SCREEN 0,0,0:WIDTH 80: END
6000 'SET THE TIME ROUTINE
6010 PRINT "Why don't you set the time (hrs. = 00 to 24; min. and sec.) now?"
6020 INPUT CLOCK$: IF LEN(CLOCK$)<>8 OR VAL(LEFT$(CLOCK$,2))>23 THEN 6010
6025 TIME$=CLOCK$
6030  CLS:RETURN
7000 ' HOW TO EXIT FROM A PROGRAM GRACEFULLY
7010 KEY OFF
7020 KEY(1) ON
7025 KEY(2) ON ' this is a second page of instructions for the first-timer
7030 ON KEY(1) GOSUB 5000
7035 ON KEY(2) GOSUB 9000
7040 RETURN
8000 ' error trapping for the save/recall routines
8010 CLS: LOCATE 1,1: PRINT "You haven't saved one!";
8015 FOR I= 1 TO 900: NEXT I
8020 CLS: RESUME 400
8030 ' see the reference manual, page [4-155] for more info.
9000 'page 2 of the instructions for the first timer
9010 SCREEN 0,1,2,2 'text, color, goto page 2
9020 LOCATE 1,1: COLOR 8,0,0: PRINT TIME$: COLOR 7,0,0
9030 COLOR 28,0,0: PRINT TAB(35); "CIRCLES - page 2":COLOR 7,0,0
9040 PRINT: PRINT
9050 COLOR 12,0,0:PRINT "Things you should know...":COLOR 7,0,0
9055 PRINT
9060 PRINT"        1.  You don't need to use <enter> excepting when more than"
9070 PRINT"            one value is asked for by the program."
9075 PRINT
9080 PRINT"        2.  It's your responsibility to keep the figures on the"
9090 PRINT"            screen.  The program's pretty insensitive to big radii"
9100 PRINT"            at the edges, but problems can be created."
9105 PRINT
9110 PRINT"        3.  Save and Recall allow only 1 picture to be kept on disk."

9120 PRINT "            If you save another, you lose the one you have."
9125 PRINT
9130 PRINT"        4.  The <T>op option allows you to overdraw the screen, keep-
"
9140 PRINT"          ing current circles while making new ones.  This is esp-"
9150 PRINT"          ecially useful for seeing the effects of different params.
"
9160 PRINT:COLOR 30,0,0: PRINT STRING$(79,15)
9170 COLOR 7,0,0: PRINT: PRINT "hit any key to go on, F1 to quit
9180 Y$=INKEY$: IF Y$="" THEN 9180
9190 RETURN
10000 END
```

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Adding a printer to your computer makes sense. But deciding which printer to add can be tricky. Do you settle for a printer with limited functions and an inexpensive price tag or buy a more versatile printer that costs more than your computer? Neither choice makes sense.

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And, of course, the STX-80 comes with Star Micronics' 180 day warranty (90 days on the print element).

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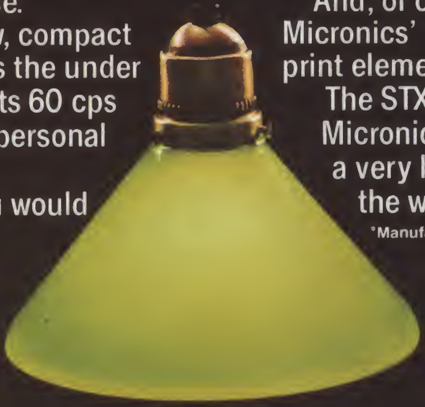

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Cache/Q is easily installed on the IBM Personal Computer. On any computer using the CP/M 2.2 operating system. And Cache/Q is easily installed on your computer. It can also utilize bank-select memory and I/O-type memory for an even greater increase in efficiency.

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Circle 86 on Reader Service card.

By Frank J. Derfler, Jr.

Traipsing Through Trendy Territory

Scoping The Field's New Products

Things are moving fast in the micromarketplace! This month, we'll share an overview of some of the newest trends and developments in both hardware and software. On the way, I'll describe a way to use even a small amount of free RAM to improve the speed of operation of your CP/M system. We'll also look at what IBM has done to keep the rest of the market on its toes.

But first, here are some current releases that might pique your interest, including a way to run Apple software on your PC.

Developments

I can report on three significant developments this month that continue to point to industry trends.

First, Les Freed and the gang at Microstuf have released a much-improved version of Crosstalk and a new communications program for unattended file exchange. Second, even before the 1-2-3 integrated information management system is off the ground, other developers are offering competing products. Finally, Quadram designers have turned the tables on the multiprocessor market. They're previewing a board for the IBM PC that will allow it to run Apple II software.

Microstuf

For those of you who don't know, Crosstalk is a smart terminal program for CP/M and MS DOS micros that has been proven and improved upon on a regular basis. It is to Microstuf's credit that it doesn't just sit back and let a good product run.

Crosstalk's new version 3, for 16-bit machines, is a completely rewritten program. The new program is both menu- and command-driven. There isn't a forest of menus to navigate through, but, if you want to use a menu, it's there and it's easy to use. If you simply want to enter a two-letter command code, you can do that from any point in the program.

Crosstalk version 3 has many features that give it improved operation. The program contains a message buffer to hold incoming data, a search function that allows you to bring a section of the buffer containing a specific word or phrase back to the viewing screen, improved transmission of files (including the capability to wait for a specific character) and the ability to act like some of the most common data terminals.

I'll have a more complete review in the near future, but if you want a super terminal program for MS DOS (PC DOS) machines, Crosstalk 3 is it!

Microstuf will upgrade an older version of Crosstalk on the original disk for $30.

Transporter

Another Microstuf program that I'll just mention for now is Transporter, a $295 electronic mail system that can transfer files to Crosstalk-equipped machines without an operator present.

The Transporter program accepts a task list that tells it to perform certain actions on certain dates and at certain times. This task list is self-prompting and logical. Even a nontechnical person would find it easy to set the Transporter program to work.

For more information on both Crosstalk and Transporter, contact Microstuf at 1845 The Exchange, Suite 140, Atlanta, GA 30339 (phone 404-952-0267).

Look out, Lotus!

Lotus Software has released 1-2-3, which combines the capabilities of an advanced spreadsheet, database manager and graphing program into one easy-to-use program. This program has created substantial waves in the industry, but there are other boats in the water, too.

Two offerings I'm watching closely are KnowledgeMan from Micro DataBase Systems, Inc., and T/Maker III from T/Maker Company.

These two powerful programs approach integration from directions that are different from 1-2-3's approach. KnowledgeMan is an enhanced database management system. T/Maker III is an enhanced program generator and word processor. They all come to similar ends, but the means are different.

Both programs confirm the move toward integrated software systems. The day when novice computer users will be able to create and use powerful applications is almost at hand, thanks to programs like 1-2-3, KnowledgeMan and T/Maker III. (Are programmers working themselves out of jobs?)

Apple into PC

Some people might claim that the world has turned upside down, but Quadram Corp. believes there is a market for people who would like to run Apple II software on the IBM PC. Quadram recently gave a private briefing on a 6502A CPU board that can be inserted into the PC to allow it to become Apple II-compatible.

There certainly is enough Apple II software available, and some people have favorite programs that they hate to abandon if they swing to the 16-bit world. The dual CPU-capability offered by the 6502A

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board would be right in line with previous moves to put a Z-80 into the PC and an 8088 into the Apple. We might find a way of making software transportable yet!

The Quadram board will allow you to stuff an Apple disk into an IBM drive and run all of the software, including hi-res color programs. This board will be ready for public release by the time this article reaches print, so Apple lovers can have their pie and a PC too!

Contact Quadram (4357 Park Drive, Norcross, GA 30093; 404-923-6666) if you're interested in this product. The retail price will be about $680.

The IBM PC XT

Speaking of the PC, let's see what impact some of IBM's recent moves will have on the market. In early March, IBM announced a series of products, including an improved PC and a new version of the PC (Microsoft) disk operating system.

The IBM XT (extended) Personal Computer corrects some of the design decisions that legions of Monday morning quarterbacks (including me) said could be "done better."

No, the poor, lonely, left-hand shift key hasn't been put back where it belongs, and the far-out position of the puny return key hasn't been improved to make life better for the typist. But IBM designers did make life easier for the commercial user and system designer.

IBM added more memory to the main board, more expansion slots, a heavier power supply and a ten-megabyte hard disk system. An expansion chassis is available, and various configurations of multiple hard disks and floppy disks can be used.

One small decision made during the design of the original PC was responsible for the creation of a multimillion-dollar spin-off industry. The decision to include only five expansion slots and to fill two with a graphics card and a disk controller left little room for system expansion. If IBM had put either more expansion slots in their machine or more input/output ports on the main circuit board, it might not have inspired the highly successful multifunction board business.

The perceived shortage of expansion slots caused fast-footed entrepreneurs to move quickly to fill the need for multifunction expansion cards that can provide many features in one slot.

This business prospered, along with the PC, and positive contributions were made to the economies of several cities around the country. IBM has obviously recognized that the public and press believe there should be more slots available in the PC, so they've put eight in the XT.

While the new PC XT has eight expansion slots, the IBM announcement associated this chassis only with a ten-megabyte hard disk system. No mention was made of plans to provide the expanded chassis for the plain PC.

The IBM Personal Computer XT features a storage capacity of more than 10.6 million characters (or 5300 double-spaced typewritten pages) in its disk and fixed disk drives. The IBM Color Display, a high-resolution, 12½-inch monitor capable of displaying 16 colors, is well-suited for business data and graphics displays, as well as text processing. The IBM PC XT costs $4995; the Color Display retails for $680.

The PC XT—with 128K of RAM on the main board, monochrome video system, one dual-sided floppy disk drive and one ten-megabyte hard disk drive—has a price of $4995. Although it wasn't made perfectly clear in the initial announcements, IBM also will sell the hard disk to users who want to add it to their existing PCs.

IBM has priced this disk aggressively (that means it's knocked the socks off the competition!) by giving the disk unit a retail price of $1695. You also need a hard disk controller for $695; that makes the price for 10M $2390. Since the controller can run two drives, 20M of hard disk will retail at $3085. Look in your catalogs and see how that compares to some of the more expensive systems.

The question asked by small-business people who make or market products supporting the PC is: "How will IBM's new moves affect my sales?"

Certainly, add-on hard disk drive manufacturers will have to scramble to meet IBM's offerings. They'll try to make room in the market by offering more storage (40M in a single 5¼-inch drive is now practical), lower prices and better disk-sharing capabilities.

The ability to share hard disk files is important to corporate users; add-on manufacturers should consider schemes to allow disk-sharing between microcomputers with different operating systems. This universal approach is one IBM will probably never take.

The multifunction board manufacturers are certainly not shaking in their boots because of IBM's increase in the number of expansion slots in the XT. The multifunction approach has proven to be a cost-effective way to get capabilities even for people with free slots in their machines.

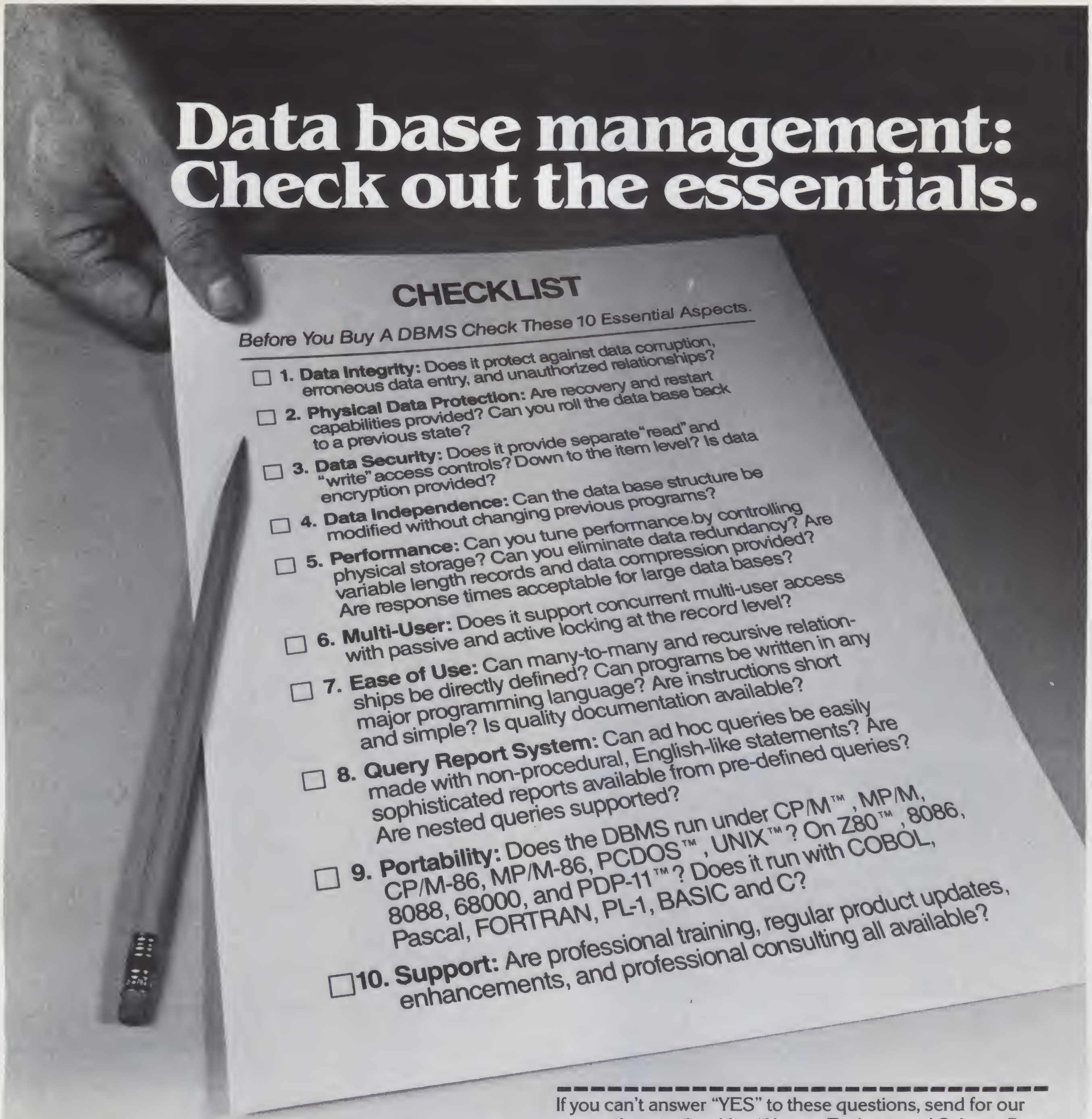
If IBM decided to put serial and parallel ports on the main PC computer board, it might be slightly harmful to multifunction board sales, but that doesn't appear to be on the near horizon.

Resemblance to Unix

The introduction of PC DOS 2.0 may, in the long run, be more important than the introduction of the new hardware. It's a larger and considerably more powerful operating system that has many operational resemblances to that popular but controversial operating system, Unix.

For those of you who have not followed

Data base management: Check out the essentials.



CHECKLIST

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- ☐ 1. **Data Integrity:** Does it protect against data corruption, erroneous data entry, and unauthorized relationships?
- ☐ 2. **Physical Data Protection:** Are recovery and restart capabilities provided? Can you roll the data base back to a previous state?
- ☐ 3. **Data Security:** Does it provide separate "read" and "write" access controls? Down to the item level? Is data encryption provided?
- ☐ 4. **Data Independence:** Can the data base structure be modified without changing previous programs?
- ☐ 5. **Performance:** Can you tune performance by controlling physical storage? Can you eliminate data redundancy? Are variable length records and data compression provided? Are response times acceptable for large data bases?
- ☐ 6. **Multi-User:** Does it support concurrent multi-user access with passive and active locking at the record level?
- ☐ 7. **Ease of Use:** Can many-to-many and recursive relationships be directly defined? Can programs be written in any major programming language? Are instructions short and simple? Is quality documentation available?
- ☐ 8. **Query Report System:** Can ad hoc queries be easily made with non-procedural, English-like statements? Are sophisticated reports available from pre-defined queries? Are nested queries supported?
- ☐ 9. **Portability:** Does the DBMS run under CP/M™, MP/M, CP/M-86, MP/M-86, PCDOS™, UNIX™? On Z80™, 8086, 8088, 68000, and PDP-11™? Does it run with COBOL, Pascal, FORTRAN, PL-1, BASIC and C?
- ☐ 10. **Support:** Are professional training, regular product updates, enhancements, and professional consulting all available?

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the progress of Unix, this operating system was developed within AT&T for its own use. It became popular with universities and gained a following every bit as loyal as that of CP/M users.

I have always been puzzled, however, by the difference between the Unix facts and the Unix fancy. I have read and been told that Unix is the "programmer's workbench." It contains many tools and utilities that make writing programs easier and faster.

Yet, despite this environment, there seems to be practically no worthwhile end-user software written for the Unix system. The programs I've seen (scheduling, executive support systems and many others) have been uniformly awful; they border on being hostile to the user. The only exception is the software running on the Fortune 32:16.

Unix has a long way to go before it comes out of its ivory tower and into the practical world.

The Microsoft DOS 2.0 running on the IBM PC (and other systems) seems to put together the best of both worlds. It is fully compatible with earlier versions of MS/PC DOS, but it has "pipes," "shells" and other features familiar to Unix programmers.

A pipe allows you to channel data and commands from one program to another. Shells are levels of commands in the DOS. An unsophisticated user would probably stay at one outer shell level and be happy, but more sophisticated users can proceed to inner-shell layers and address more of the arithmetic and data-movement functions of the microprocessor.

The new DOS 2.0 also contains many options in the use of disk directories. These functions give you the ability to see only those categories of files you are interested in.

All of the added capabilities take up room, so DOS 2.0 is larger than DOS 1.1. If you're reaching the limits of your memory, you should consider buying more memory.

IBM has served notice to the rest of the microcomputer industry that it will not be stagnant. If you're going to ride on Big Blue's back, you're going to have to hop to keep up.

Things to Do with RAM

As the prices for solid-state memory continue to drop, manufacturers and dealers are finding more and more things to do with memory.

Many of us have an early mentality that says an eight-bit computer cannot use more than 64K of RAM. Technically, it is true that the eight-bit chips can't address more than 64K simultaneously, but on a practical basis there are many ways to use cheap and fast RAM, even in an eight-bit machine.

Blocks of RAM with more than 64K can be used as pages of memory that are electronically moved in and out of the eight-bit processor's addressing scheme under control of a program or system monitor. This can be effective for specific programs and it's often done in multi-user systems, but changing pages or "banks" of memory requires sophisticated hardware and software.

A simpler way to take advantage of the speed of solid-state memory is to designate large sections of memory as a solid-state substitute for a disk drive or RAM-disk.

RAM disk software is readily available. Most RAM manufacturers give away a RAM disk program with their RAM cards. This approach can be used equally well by eight-bit and 16-bit machines.

Briefly, the RAM-disk software modifies the operating system so that data sent to a specific disk (usually D on systems able to handle four drives) is written to a special block of RAM memory instead.

This system has the advantage of being fast; the amount of time needed to read or write to a disk is reduced tremendously, particularly if the normal system disks are the relatively slow 5¼-inch floppies. This improvement is most important when you are using programs like database managers, general ledgers or language compilers that frequently have to access the disk system.

This RAM-disk capability isn't without problems. Many programs (WordStar, for instance) are written to use disk A as the home disk. If they are put into a RAM disk to speed their operation, they'll still run, but given the slightest excuse (exiting the program to run a spelling checker), they will revert back to disk A. This is inconvenient and could be confusing to the user.

A second problem with RAM-disk operation is that the files in RAM are not permanent. When the power goes off or the system is reinitialized, the RAM is wiped clean. If you do not frequently save your RAM disk data to a "real" disk, the results of a power surge or shock from static electricity could be frustrating.

Disk Buffering

There is a method of using RAM to speed disk operation that does not include the risk of losing data or of confusing program overlays. This method is known as disk buffering. It involves reading large sections of the working disk into RAM memory, where they are held until the program needs to read them. If the called section is in RAM, it is used. If it is not in RAM, the data is read from the disk in normal fashion and no time is lost over normal operation.

Disk buffering can be used even within 64K systems to speed up operation, so it doesn't really need extra RAM. But if you have extra memory, it can use it to provide even greater improvements in performance.

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Other advantages of disk buffering are that it provides increased speed of operation at a low cost, it can't cause permanent loss of data if the system is reset and it allows programs to function normally—without you having to worry about what disk drive they're on.

Cache/Q

Cache/Q is an excellent disk buffering program designed for CP/M users. It can function within a 64K machine (I run it in a TRS-80 Model II with CP/M) or it can use up to 1.5M of RAM as disk buffer storage.

The program contains a great deal of logic that determines what portions of the disk should be copied. These decisions are made based on the amount of use, the amount of RAM available for storage and the configuration tags you set into the program.

In normal operation, if the application program requests a data item not available within the disk buffer, the Cache program reads and stores the entire disk sector containing that information. If your application program frequently reads from the same areas of the disk, your average disk access time can be reduced from nearly one-half of a second to only 1.3 milliseconds.

I found Cache/Q software easy to install and easy to use. The installation program asks you some questions, but it has default values that allow it to operate with the majority of CP/M systems. You'll have to make special entries into the installation program only if you are going to use large blocks of memory or if you have a specially configured CP/M system.

In use, the program can be totally invisible. You don't have to worry about moving program and data files from disk to disk as you do with RAM disk systems.

> Cache/Q is an excellent disk buffering program for CP/M users.

I set my Autoexecute function to call the Cache/Q (CQ.COM) program when the system is booted up. The only way I know it is working is by noticing that the disk drive doesn't come on as frequently.

With Cache/Q I can delete a line or center a heading in WordStar without waiting for the usual disk operation. I can compile a source code listing in less than 20 percent of the time it takes without Cache/Q in the system.

Cache/Q has several other features that make it valuable. It has an internal print spooler that will take the output of a program directed to a printer, capture it and feed it to the printer at speeds the printer can handle. While Cache/Q is working with the printer, you can use another program or be doing other work.

Cache/Q also has the ability to buffer the data being written to the disk. If you choose, you can tell the program to hold the data to be written until you direct the program to dump it to the disk. This can increase the speed of certain programs, but it introduces the possibility of losing data and should be used with care.

The folks at Techne have done an excellent job of documenting their program. The manual includes illustrations, explanations and demonstration programs. My manual came with a number of posted updates and the whole thing was contained in a nice binder. An index would be a welcome addition to the manual, but a large table of contents is provided.

Cache/Q is a useful and practical addition to any CP/M system. It carries a list price of $225.

For more information, contact Techne Software Corp., 3685 Mt. Diablo Blvd., Suite 130, Lafayette, CA 94549 (phone 415-283-6824).

* * *

Read Me In

If you have a product that is going to make an impact on the industry, or if you simply have a better way of doing things, let me know. Drop me a line or send some electronic mail to TCB967 on the Source or 70003,455 on CompuServe.☐

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By Robert W. Baker

CMS Offspring: Southern Solutions

Software For Work And Play

Southern Solutions

Most old-time PET users should remember CMS Software of Dallas, which produced the first accounting package for the Commodore 2001 PET, way back when . . . Well, Southern Solutions was born out of CMS as a vehicle to make more quality products (including the CMS software packages) available for a larger number of users.

Southern Solutions supports industry efforts to curb software piracy and unlawful program proliferation. Most of its software requires that a "dongle" be connected to the datasette recorder connector.

You can think of the dongle as the key to using a program; without owning the key, you cannot use the software. A custom dongle is supplied with each program and the corresponding program will run only if the correct dongle is installed.

The programs are supplied on normal Commodore-format disks that can be duplicated for backup purposes following normal procedures. In most larger packages, some of the programs can be listed, so the user can incorporate special modifications if necessary. (Southern Solutions has a standing offer of a $10,000 reward for information leading to the arrest and conviction of anyone violating its copyrights.)

Catalog Contents

Southern Solutions' 30-plus-page catalog includes the System IV Accounting System (for users associated with larger businesses), the System III Accounting System (general accounting program for first-time users), Commodore-64 BusinessWare (for nonprofessional computer users), LearningWare (educational programs for the C-64 and VIC-20) and FunWare (C-64 entertainment programs).

Instructional tape cassettes and dealer demonstration disks are available for all of the company's business software. Sample printouts for the business and educational programs can be obtained.

A special subscription service for upgrading all of Southern Solutions' business software packages is also available. This includes monthly revisions of the latest changes to each program.

The mailing includes a listing of affected programs within the package, so users with special programming changes can elect to not implement a particular change. Discounts are available for multiple-system support.

System IV Accounting System

The System IV Accounting System is a fully interactive general accounting system designed for the larger business user, with a number of support modules for a wider variety of applications.

The suggested system configuration for this program includes a CBM-8032 with an 8250 disk and a Mannesmann-Talley 8024-L printer. An 8050 disk can be used with some disk interchange.

The special SuperMath feature allows entry and use of numbers of up to one billion dollars; this provides calculation accuracy of larger numbers normally not available in smaller systems.

FileGuard II provides protection for irreplaceable data files. It assures the user that all data files and interim posting data will remain intact if electrical power is lost.

Most reports can be displayed or printed; printed reports are 80 or 130 columns wide. All input requests are fully prompted, with complete verification of input data. The instruction manual gives explanations of each step and prompt, as they're encountered by the user, along with sample reports generated by the system.

Vertical programs and systems that take advantage of the capabilities of the System IV are available. Modules not included in the vertical packages may be added at any time to provide a truly custom-tailored software product. Be aware, however, that some vertical and special programs have hardware requirements the standard System IV doesn't meet.

System IV modules include:

- General Ledger—Allows over 4000 accounts with an 8250 disk; is fully departmentalized with up to 99 departments; can be used alone or can accept postings from other modules.
- Accounts Receivable—Allows 3600 invoices and customers per 8250 disk; can be configured as either an open item or balance forward accounting system; offers complete invoice aging reports, special overdue invoice reports, sales tax and commission reports, and mailing labels.
- Accounts Payable—Allows 5000 invoices and vendors per 8250 disk, prints checks with complete voucher detail, credit memos, term discounts, full and partial payments, complete aging reports, special cash requirements analysis reports and mailing labels.
- Inventory—Designed for a retail environment providing up to 7000 items per 8250 disk; allows printing of bids and proposals and user-definable reports.
- Payroll—Maintains current, quarterly and yearly totals for up to 700 employees per 8250 disk; calculates and prints payroll checks with full deduction and pay detail.
- Job Costing—Provides small-order and medium-order contractors with the ability to establish budget items for a particular project and then post invoices and payroll to that job by cost item. Provides reports and detailed analyses for each job on a month-to-date, year-to-date and project-to-date basis.
- Budget Development—Designed for nonprofit organizations or others relying heavily on budget information; provides interface with VisiCalc.

As mentioned earlier, a number of vertical and special packages are being offered by Southern Solutions. These con-

Address correspondence to Robert W. Baker, 15 Windsor Drive, Atco, NJ 08004.

sist of several of the standard modules with some customization or additional modules to provide special functions:

- Encumbrance Accounting
- Oil Accounting
- Pharmacy Management System
- Church Records System
- Hotel Management
- Hospital Management
- Capital Asset Management
- Client Billing

System III Accounting System

The System III Accounting System is a fully interactive package designed for the first-time user. It's especially useful for small businesses with significant files of accounts, customers, vendors, employees and invoices.

The suggested system configuration includes a CBM-8032 with an 8050 disk and a 4022 printer. The 4040 and 8250 disks can also be used.

System III contains FileGuard I, designed to protect irreplaceable data files. Although not as sophisticated as the FileGuard II used in System IV, it assures the user that all data files will remain intact if electrical power is lost. Otherwise, System III user interfacing is similar to that provided by System IV; the same is true of System III's documentation.

System III, which can be upgraded to System IV, includes General Ledger (for up to 1000 accounts), Accounts Receivable (for up to 1800 invoices and customers), Accounts Receivable (for up to 1950 customers), Accounts Payable (for up to 2500 invoices), Payroll (for up to 350 employees) and a complete Mailing List Manager (with multiple user-defined formats).

BusinessWare (for the Commodore-64) provides full-featured, computerized record-keeping designed for the nonprofessional computer user, bookkeeper or record manager. Although some packages are for home or professional use, most are perfect for the small or at-home business.

The programs were designed for the typical C-64 configuration with a 1541 disk, a datasette tape drive and a 1525 printer. They also will support any Commodore disk or printer, plus Corvus hard disk drives and standard ASCII printers.

The programs contain professional-level file structures developed for use in larger systems but available at prices affordable by the smaller user. The programs allow the storing of data on the main 1541 disk drive and a separate disk; they also allow the trading of disks in the main drive and the storing of data separately from programs. Historical files can be copied to a second disk or to tape.

All programs contain FileGuard II to protect the data files. Additionally, files can be transmitted through a modem to another computer by using the MailBox package and the standard VIC Modem.

BusinessWare

Available BusinessWare systems include:

- BusinessMan (general ledger)
- BillPayer (accounts payable)
- BillCollector (accounts receivable)
- PayMaster (payroll)
- RecordKeeper (database manager)
- MailMan (mailing list manager)
- TimeKeeper
- ClubManager (for club financial records)
- BudgetCommittee (for home budgets)
- FlightPlan (for flight logs and record-keeping)
- ScoreKeeper (for amateur athletic league records)
- SpeakerMan (for members of Gideons International)
- MailBox (modem driver)

LearningWare

The LearningWare series of programs was designed specifically for the C-64 and the VIC-20. All of the programs will run on the C-64 *or* the unexpanded VIC-20 (but memory expansion may be used). All programs are available on disk or tape. This set of educational programs ranges in subject and skill level. It's designed to supplement elementary, junior and senior high school courses.

Programs are user-friendly and safeguarded against accidental program exits. They're especially useful in drills and other educational applications requiring repetition and memorization.

Where appropriate, the programs score each completed drill with a percentage and a letter grade. Provisions are made for altering the letter grades to fit the user's grading system.

Besides the general-purpose Flashcard program, LearningWare programs include:

- Foreign Language Drill
- States and Capitals
- Countries and Capitals
- Name the Presidents
- Morse Code Tutorial
- Letterhead
- Grocery List
- Memo Pad (a household message center)
- Painting Helper (computes materials needed)
- Little Invoice (small-business invoices)

FunWare

The Commodore-64 FunWare programs are strictly for entertainment. Only one package of ten programs (the Play Time Package) is currently offered with Baccarat, Backgammon, Blackjack, Checkers, Craps, Cribbage, Go, Moku, Qubic 4, Reversi and Dicey Poker. These programs use the high-quality sprite graphics and sound synthesis capabilities of the C-64, and all programs are compiled for fast action.

If the new offerings from Southern Solutions are anything like former CMS

THE QDI 40/80 VIDEO CARTRIDGES

Quantum Data, Inc. produces two 40/80 Video Cartridges for the Commodore VIC-20 computer. The Video Cartridge which does not contain memory, and the Video Combo Cartridge which contains 16K RAM composed of eight 6116 CMOS memory chips.

The 40/80 Video Cartridge or the 40/80 Video Combo Cartridge is the means to upgrade the VIC-20 computer to a 40 × 24 or an 80 × 24 character display. This provides a wealth of new uses for the VIC-20 and with the appropriate software you can now accomplish quality word processing and various business functions that previously were difficult to achieve with only the VIC's standard 22 character video display. Both Cartridges feature a screen printing routine and a terminal emulator routine which are written in BASIC so that you can add these capabilities to your programs.

Either Cartridges can be plugged into the memory expansion port of the VIC-20 or an expansion chassis. The 40 character mode may be easily viewed on most standard T.V. sets but a monitor is required for the 80 column mode to provide the necessary additional resolution.

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products, they should be well worth looking into.

The sample copy of the BusinessMan was excellent; having used the former CMS General Ledger, I found the new program to be a great improvement and extremely easy to use. It's supposed to sell for less than $100 retail, compared to the price of about $300 for the CMS software when it first appeared.

For more information, write to Southern Solutions at PO Box P, McKinney, TX 75069.

Commodore Computers For Preschoolers

Preschoolers are stepping into the future as they use Commodore computers to develop basic skills. Three- to six-year-old children are attending Kindercare Learning Centers where an innovative computer learning program is available.

Since the preschoolers haven't learned to read, they're given directions by a natural voice recording played on a tape recorder connected to the computer. The children use a light pen to answer questions in learning pre-math and pre-reading concepts, memory skills, colors, shapes and concepts such as over/under.

Kindercare, the largest nationwide childcare facility, started using the Commodore PET to teach preschoolers in June of 1982. With the help of Fisher Scientific, Inc., systems were installed at eight childcare centers in Minneapolis and later expanded to 35 centers in Houston.

The Commodore computers proved to be so reliable and successful as a teaching tool that, in January 1983, the program was expanded again and Commodore-64s were installed in 11 centers in the Montgomery, AL, area.

Preschoolers are getting a jump on technology. This quartet of tots is tightening its counting skills on a Commodore-64.

Printer, Are You There?

If you're writing a program that involves the use of a Commodore printer on a PET/CBM to print forms, the subroutine in Listing 1 may be of interest. It's intended as an initialization routine for the printer and does a little more than just open the device.

The routine first resets the printer to a known state and checks that the printer is connected and turned on (lines 1000–1060). A status of −128 in ST indicates that the printer does not respond; the routine then will ask the user to turn on the printer, delay a short while and recheck the printer status.

Once the printer responds properly, the routine proceeds and line 1070 puts the upper/lowercase mode into effect. The printer is then opened for normal printing.

When you've positioned the forms as desired, press the space bar. The print in line 1120 resets the top-of-form position and enables selection of a page mode in the printer.

If necessary, you can add additional printer commands to set the page length, line spacing or whatever. Most of the other parameters normally do not have to be changed if you're using standard 11-inch forms.

Now you have a clean method of initializing the printer prior to starting any process that will generate printed output. If you'd like to make it even fancier, try adding or changing these lines:

```
1015 GET X$: IF X$ = "Q" THEN END
1110 GET X$: IF X$ = "Q" THEN END
1115 IF X$ <>" " THEN 1110
```

If you have trouble getting the printer to work, you can terminate the program by hitting the Q key.

By the way, when using the paging mode in the printer, don't forget that you can do a top-of-form by using a CHR$(12) in your print statement (at least you can with the 8023P printer). After your last form is printed, however, you probably won't want to do a top-of-form to eject it from the printer. If you do, the paper may advance an extra line when you close the printer. When this happens, you'll have to realign the forms the next time you run the program.

On the other hand, if you advance the forms manually with the top-of-form switch on the printer *after* the printer is closed, the forms then will be correctly positioned for the next time.

Misc

Commodore just completed negotiation of a 17-year lease for a half-million-square-foot facility located in the Brandywine Industrial Park in West Goshen (PA) Township, adjacent to the West Chester County Airport.

The move to the Chester County location in April consolidated activities previously located at various points in the Wayne, PA, and King of Prussia, PA, areas. The new building will become the headquarters for CBM's US manufacturing, distribution, warehousing, marketing and sales activities.

From the "VIC-NIC News" comes information of a correction to the VIC-1515 printer manual. On p. 37, step 60120 needs a semicolon between G0$ and the colon to keep the VIC from doing one extra line-feed between printed lines.

The statement below the program about Cursor Down Mode is incorrect and should read:

In line 60010 CHR$(145) should be changed to CHR$(17)

As I mentioned last month, the Independent Commodore Products User Group (ICPUG) will supply overseas subscriptions to its newsletter to interested parties. The person to contact is Jack Cohen, 30 Brancaster Road, Newbury Park, Ilford, Essex, IG2 7EP, England. The subscription rates were quoted in British pounds—20.00 for airmail and 11.00 for surface.

As I said last month, ICPUG's newsletter is one of the best I've seen for PET/CBM users.

February and March "PET-pourri" Follow-ups

If you had problems with the second example program in the February 1983 "PET-pourri," my apologies. There was a small typo in line 30 that went unnoticed. Add STR$ before the (L) near the end of line 30.

In my March 1983 column, I mentioned the possible problems with using the VIC-20 and C-64 on Zenith television sets. It turns out that the same problem may exist with some Sylvania sets as well.

For VIC-20 owners, a POKE 36864,133 should improve your picture quite a bit, *but it cannot* be used with most cartridges. C-64 owners aren't so lucky; there is no poke to correct the problem from within the computer.

Also in the March "PET-pourri" column, I mentioned a VIC-20 supplier list available from Colin F. Thompson. Well, the list is actually free to anyone interested; send a self-addressed stamped envelope to Colin at 1307 Colorado Ave., Santa Monica, CA 90404. (The March list included over 200 entries!)

A few people have been complaining about not being able to catch me on CompuServe after I said I was trying to check in frequently.

I've been pretty busy at work with a new position, but I've still been trying to check in. My only problem is that the local input number always seems busy—at least when I try to check in. I'm still trying, but generally I can get on only once every week or two.

If you need to reach me sooner, drop me a note and include a SASE for a response. □

```
1000 OPEN 10,4,10
1010 PRINT "   <-25 spacess->    "
1020 PRINT#10
1030 IF ST<>-128 THEN 1070
1040 PRINT CHR$(145);"PLEASE TURN ON PRINTER";CHR$(145)
1050 FOR X=1 TO 5000: NEXT: GOTO 1010
1060 CLOSE 10
1070 OPEN 7,4,7: PRINT#7: CLOSE 7
1080 OPEN 4,4
1090 PRINT"ALIGN FORMS IN PRINTER &"
1100 PRINT"   PRESS SPACE BAR WHEN READY"
1110 GET X$: IF X$<>" " THEN 1110
1120 PRINT#4,CHR$(147);
1130 PRINT"PRINTER READY..."
1140 RETURN
```

Listing 1. Printer initialization routine for a PET/CBM program using a Commodore printer.

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LETTERS TO THE EDITOR

What About TI?

I'm just getting started in computing, and I think you have a good magazine. But how about some articles on the Texas Instruments 99/4A?

According to a report by Future Computing, Inc., at the end of 1982, the TI-99/4A had the fourth largest base of customers—following the VIC-20, Apple II and Timex-Sinclair 1000. It seems to be more popular than the IBM Personal Computer, a system which receives a large portion of space in your magazine.

Keep up the good work. Even though *Byte* is three times as thick, I think *Microcomputing* is better.

Hessel Kooistra, III
College Station, TX

Too Much of a Risk

The cardiovascular disease risk assessment program listed in D.C. Shoemaker's article "Healthful Hints from Heath" in the January 1983 issue (p. 48) has a problem concerning the constants to be added to some of the risk-factor variables.

The totals tallied for the risk assessment are too high for inputs in the range 3 to 6. For example, the listing for a person's age increment is given as follows:

```
210 IF A = 5 THEN A = A + 1
220 IF A = 6 THEN A = A + 2
```

So, for an input of age category 5, the variable A is not scored as 6, as might be expected, but as 8.

There are similar bugs:

330/340	for the variable	H
610/620	"	T
740/750	"	E
1050/1060	"	P
1160/1170	"	S

Correct calculation is obtained in each case by preventing the program from "falling-through" to the following line, and thus preventing a double increment of the variable. For example:

```
210 IF A = 5 THEN A = A + 1:GOTO 230
```

The same idea is applied to all the other lines where "fall-through" will occur.

C.G. Harvey
Canberra, Australia

Reply:

Mr. Harvey is absolutely right; the "fall-through" in the lines he indicated fails under certain conditions. Fortunately, the program fails on the conservative side, and overstates, rather than understates, the risk of heart attack. Nevertheless, my apologies to all those who typed in the program only to find some unexpected results.

For those who would like a copy of the corrected program, please send a SASE ($.20) and I'll be glad to send a printout. If you are fortunate enough to have a Heath/Zenith computer, send a 5¼-inch hard-sector disk and $.80 in stamps and I'll send a copy.

D.C. Shoemaker
HQ USEUCOM Box 897
APO NY 09128

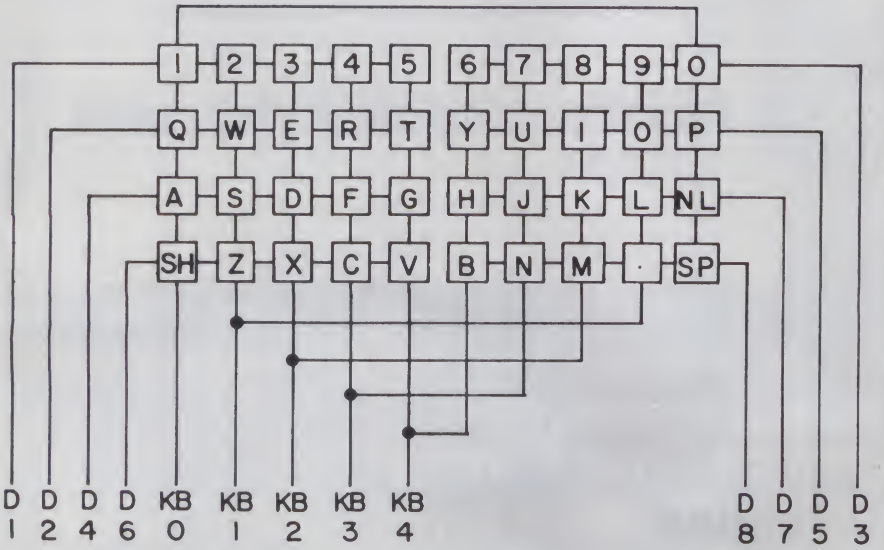

Fig. 1. The corrected figure from Jim Stephen's article "A TS-1000 Keyboard You Can Get Your Hands On." Note that keys 5-6, T-Y, G-H, and V-B are not connected.

Mea Culpa

Several of us computer enthusiasts out here in California are strong supporters of *Microcomputing*, but we must confess our sins. We have failed to be responsible readers.

On p. 7 of the March issue, we learned about "Reader Responsibility." We find that one of our responsibilities, "as a reader of *Microcomputing*, is to help increase the magazine's circulation and advertising. . . ."

We find it increasingly difficult to face each new day with a guilt complex. Readers of *Microcomputing* in our area are seeking the advice of counselors, since it is impossible to sleep soundly with the knowledge that we have failed to be responsible. To date, we have managed to keep our sins of commission secret from our families and friends.

One member of our group, clearly a radical, hinted that maybe the reason for the announcement in the *March issue* was to bolster profits for *Microcomputing*. The other members of our group, including myself, were quick to denounce such irresponsible statements.

Please rest assured that we are going to do everything we can to clear our names of the stigma of reader irresponsibility, and we trust that you will not judge us too harshly.

B.C. Banks
Fremont, CA

Reply:

Mr. Banks, your letter is typical of many we have received. Reports from churches across the country have been flooding our offices. It seems that our readers are flocking to the confessionals to be absolved from the heinous crime of "reader irresponsibility."

We are aware of the situation and are making attempts to help our readers through this, their troubled time. Efforts are being made to form a reader-irresponsibility hot-line to comfort those who find they can't face the day-to-day burden of their offenses.

—Eds.

No Connection

In the April issue of *Microcomputing*, you published an article on converting the Timex-Sinclair 1000 to a full-size keyboard ("A TS-1000 Keyboard You Can Get Your Hands On," p. 54).

I followed the steps of the article; however, when I was finished, the keyboard didn't work. I have discovered that the error is in Fig. 1 (p. 54).

In order for the keyboard to work, there should be no connection betweeen keys 5 and 6, T and Y, G and H, and V and B. Once I broke these connections, my keyboard worked fine.

Joe Matherly
Miami, FL

Reply:

Mr. Matherly is correct. An error was made in the preparation of Jim Stephens' article "A TS-1000 Keyboard You Can Get Your Hands On," April Microcomputing, *(p. 54).*

In Fig. 1, the keys 5-6, T-Y, G-H and V-B are tied together, but should not be connected. See Fig. 1 for the correct diagram.

—Eds.

Dusting Off Back Issues

As you finish reading an issue of *Microcomputing*, do you toss it on a dusty stack of past issues and feel like the old man adding a piece of string to his string ball? You're not sure why you save that stack of issues, but, as with the ball of string, you may need it someday.

Well, recently I've found those dusty past issues enormously useful for two evening courses I'm teaching.

I teach an Introduction to Computers course and an Introduction to Basic Programming course for the Minneapolis public schools community education program.

In the Introduction to Computers course, I have students to whom computer talk is totally alien, as I rightfully guessed when I was developing the course. The course doesn't require a book, so I had to create a lecture format that was easy for the students to understand. I knew the vocabulary that I use as a systems engineer would be incomprehensible to my students, so I had to find a way to simplify terms and concepts to make them more digestible.

As I developed the course, I looked through past issues of *Microcomputing* to find information on topics in my course outline. Not only did *Microcomputing* articles provide the information that I needed, but the articles helped me present the information to my students in a way they could understand.

For the Basic programming course I teach, *Microcomputing* articles and programs showed me how an Apple II works. I teach the course with six Apple II computers. Since I don't own an Apple, and since the course is for general Basic concepts, I didn't want to buy books about Apple Basic. With help from *Microcomputing* articles, I was able to figure out some fine points and do a lot with the Apples.

I don't keep a string ball, but you can sure bet I'll keep that dusty stack of *Microcomputing* back issues. And besides, who knows, someday they may be collectors' items.

Chuck Emerson-Henry
Minneapolis, MN

Two "Small Wonder" Errors

Two errors managed to find their way into print in my article ("A Small Wonder," March 1983, pp. 72–81). On p. 75, in the body of the article, one sentence reads "If you have a 16K memory module, change line 8380 from 8000 to 56000. . . ." This should have read: "If you have a 64K memory module. . . ." The value 8000 is correct for a 16K memory module.

In Table 2 (p. 81), the variable N contains the number of records stored in array I$, not "1" as printed. I regret any inconvenience caused by these errors.

Russell King
Regina, Saskatchewan

Who Shot First?

Jim Hansen must have been on R and R in Hawaii, missing the start of the "microcomputer revolution" by a good six months. The first shots were fired here in Blacksburg, VA, in July 1974, when the people at *Radio-Electronics* published my article on the Mark-8 minicomputer. This computer used the Intel 8008 processor. It's acknowledged as the computer that got hobby or home computers off the ground.

So much for revisionist historians.

Jonathan Titus
Blacksburg, VA

Editor's note: Mr. Titus alludes to Jim Hansen's article "The Quintessential Computer" (April Microcomputing, *p. 66).*

Help!

In Allan Rogers' article, "Don't Gum Up the Works!" (December *Microcomputing*, p.100), he lists a catalog labels printing program. I entered and saved the program, but I can't get it to run due to an "illegal quanity error" in line 7010:

```
7010 HTAB INT ((40-LEN (A$)) /2) + 1
```

I'm new at this, so I can't figure out what is wrong. Can you help me? I have an Apple II Plus.

Michael P. Kaufmann
Saratoga, CA

Reply:

The subroutine at lines 7000–7030 serves to center on the screen the text string sent to it in the variable A$. The

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subroutine is called from several lines throughout the program, such as lines 120, 140, 160, 610 and so on. The formula used is similar to the one we were taught in typing class to center a title on a page.

The only Applesoft key word which would produce an "illegal quantity error" is the HTAB. It issues an illegal quantity error if its argument is less than 0, which will occur of the length of the string variable A$ in line 7010 is longer than 41 characters. (HTAB also issues an illegal quantity if its argument is greater than 255, but that is not likely here.)

Mr Kaufmann will have to determine two things to correct the problem. First, run the program until the error is encountered. Then type "PRINT A$, LEN(A$)". This will show you what is in the string and its length. From there, you can backtrack and find what line is sending the lengthy string to the subroutine at line 7000. Retype the line and decrease the character count. It is not possible to center a string on the screen if its length is greater than 40 characters. Therefore, be sure to keep all of the strings you send to this subroutine shorter than 40 characters.

Allan L. Rogers
Bonita, CA

Up a Notch

Congratulations! Your magazine just went up yet one more notch in my esteem. The March issue of *Microcomputing* included not one, not two, but three articles about the Timex-Sinclair 1000 computer.

I always waited impatiently for the next edition of *Microcomputing* to appear on the shelf, and my interest in reading it has always been high.

My personal computer, however, is *only* a Sinclair ZX-81 with an assembler/disassembler/debugger software package. I had to search desperately to find articles on this micro, even though the statistics say it's the best selling personal computer on the market.

A grown-up magazine, such as *Microcomputing*, has finally revealed an interest in this Timex-Sinclair marvel. Many thanks; you've given me some hope.

Daniel Poirier
Ottawa, Ontario

Teachers, Take Note

I have a number of software programs that are being used in history/geography classes. I would be willing to share these with you, to use in your classes. The information and programs are *free*.

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Keith L. Drieberg
Riverside, CA

Where Have They Gone?

I would appreciate any information on persons who worked for Processor Technology Corporation (6200 Hollis St., Emeryville, CA 94608)—maker of the SOL-20 computer.

The company is no longer in business, and I would like to know where personnel and spare parts went.

John DiSalvo
Box 823
Rocky Point, NY 11778

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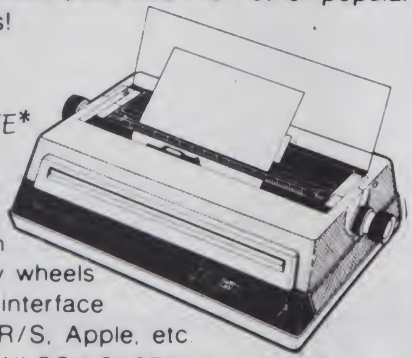

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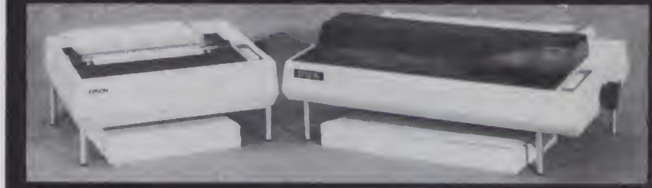

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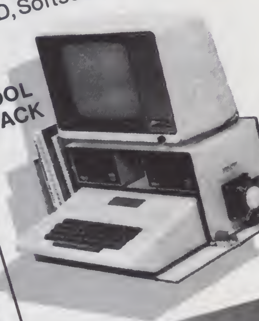

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Banking on Micros

Bankers' interest rates in microcomputers are soaring as they find that micros are easier to use, less expensive and, in some cases, more effective than mainframes and minis.

By Robert H. Long

During the past two years the financial services industry has become enthusiastic in the use of microcomputers. This isn't surprising, because financial services essentially are an information-based business. What is surprising is the degree to which chairmen, chief executive officers and other senior officers have become advocates of microcomputing.

In the past, bank officials have delegated computer usage to the data processing technicians. With the micro, they have become active users. This became clear as the first cases of micro usage emerged.

Emerging in Banks

In 1980, during the early days of microcomputing in banking, James King, president of People's National Bank of Albia in Albia, IA, had five TRS-80s installed in his bank. He and his officers programmed them to do loan and CD (Certificate of Deposit) calculations, IRA analysis and disclosure, corporate tax estimates, accruals and loan analyses and to model different decision situations for their agricultural customers.

King's answer as to why they were using micros and "doing it themselves" is the classic reason why bankers across the country got into micro banking: "All of these operations," he said, "could have been done on a large system, but the cost, the delay and the problems in keeping them updated made the micro—with its ease of modifying the programs—the best choice."

Another forward-thinking banker is Larry McGregor, former president of the Bank of Wheaton in Wheaton, IL, and currently chairman of Premier Banks of Illinois.

"I believe that, within the next five years, any bank officer who does *not* use a computer directly in his work will be functionally illiterate," McGregor said. "And we cannot afford to have functional illiterates in senior positions in our banks."

> Any bank officer who does not use a computer directly in his work will be functionally illiterate.

Subsequent surveys conducted by *Microbanker* serve to verify and amplify the thoughts of these early users.

According to these surveys, the main reason financial institutions were using micros was that their mainframe data processing centers could not fully serve their needs in a timely fashion. Regulation changes, new services, the need for special reports and analyses and increased competition made fast, precise and customized quantitative analyses a requirement for business success.

Data centers, traditionally short of skilled personnel, struggling with the high volume of transactions, processing applications and often using technically obsolete hardware and software, just couldn't cope with the demand. The answer for many bankers was the microcomputer.

Other reasons for using the micro that emerged from the surveys are:

- Micro software makes it easy for officers to develop specialized decision-aid models.
- Micros have proven to be an excellent sales-support tool for selling complex financial services.
- Micros are extremely easy to justify when they're applied to low-volume tasks that are still being done manually.
- Micros can replace expensive time-sharing services and sometimes even do a better job.
- Micros offer an inexpensive tool for training and upgrading analytical skills.

Microbanker researchers estimate that 6000 of the nation's 14,000 banks already have installed micros, and that another 4000 are in the process of obtaining them. It's not at all uncommon to find five or six microcomputers in a bank with only 30 or 40 employees—even when the main processing tasks are being processed on a central large-scale computer.

Savings and Loans, Credit Unions, Finance, Mortgage, Investment and other financial service institutions are also rapidly adopting micros.

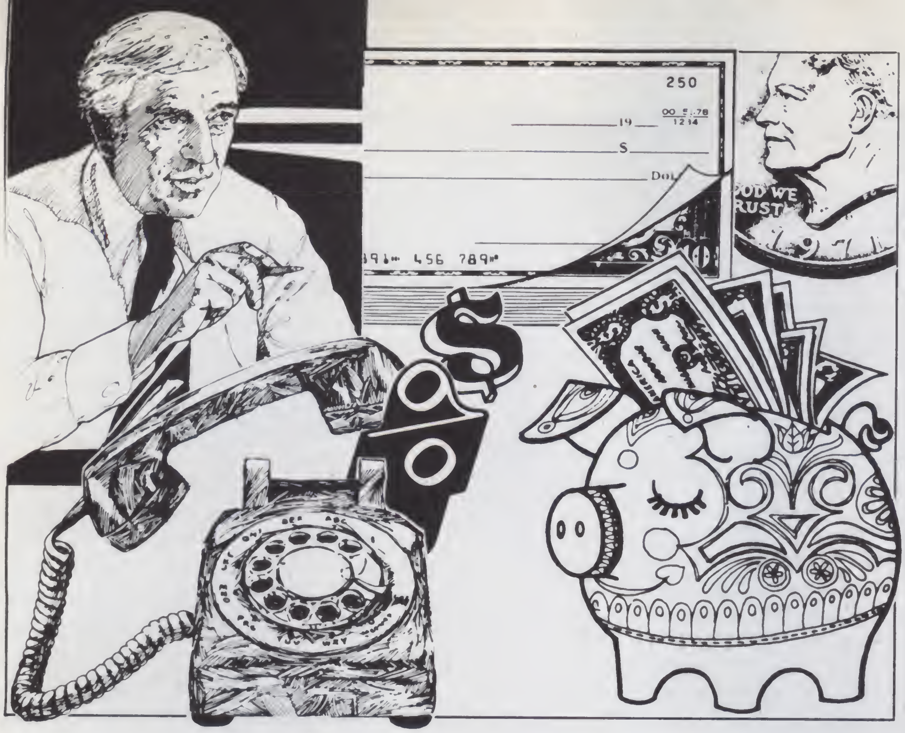
Decision Aids

For a financial institution, the microcomputer's power as a decision aid is by far its most popular feature. Bank officers use them extensively in playing "what if."

In using micro-based decision-aid models, they can ask: What if interest rates change? What if loan demand drops? What if costs rise? What if we

---

Robert H. Long (PO Box 95193, Schaumburg, IL 60195) publishes Microbanker, *a monthly research report that examines the growing use of micros in banking.*



change our pricing structure?

Micros often are brought into the business to help answer these questions; then they expand into other uses.

"We were using a time-sharing terminal, but we bought an Apple, expanded its memory, learned VisiCalc and began doing some budgeting and forecasting," said Ron Duitsman, President of University National Bank in Chicago. "We found that we could do the same things with VisiCalc that we did on time-sharing, so we discontinued time-sharing . . . and saved $400 a month.

"We now use our Apples for many other things: board reports, earnings analysis reports, bank acquisition analyses, tax analyses, pricing studies, bond swaps, asset/liability management, liquidity analyses and even for scheduling our tellers and keeping track of exception items," Duitsman said.

University National, a $40 million bank, provides an accurate example of how smaller banks grow into micro use. It currently uses four Apple IIIs, each equipped with a hard disk, and two Apple IIs.

University National's officials found that their employees can learn to use micros with little or no instruction by working with the tutorials and instruction manuals that come with the various programs. They've also found numerous instances where it is much more economical to do analysis and processing on micros than on a main data center.

Bankers make extensive use of "calc" programs in decision-aid use of micros. Packaged programs for financial decision-making are becoming available in growing numbers. At last count, *Microbanker* researchers had located more than 30 different asset/liability models that run on microcomputers.

Programs are also used for calculating customer profitability, doing financial planning and bond swap analysis, staffing requirement studies, hedging analyses, pricing studies and planning estates. The prices of these software programs range from several hundred dollars to more than $30,000.

Originally, bank officers gulped a little at the thought of paying five or six times as much for a software program as for the machine to run it. But the higher-priced programs generally include an educational program and implementation help. And when it also helps you do important things that can be translated into major profit improvement, the cost is easily justifiable.

Customized workstations are the newest development in micro-based decision-aid tools. Executec in Dallas, Financial Data Services in Bakersfield, CA, and several other software development companies are developing customized workstations for different sets of responsibilities.

A controller's workstation might consist of a micro with an integrated set of models and databases to enable him to monitor cash flow and costs, carry out pricing studies, calculate asset/liability management analyses

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and budget tracking, and a host of other tasks. It also might enable him to communicate with other controllers and to research financial regulations.

Sales Aids

The micro is fast becoming an important tool in expanding customer services. A prime example is BranchBanker, a financial institution lobby sales-aid program developed by Ampersand Corp. (PO Box M-84, York, PA 17405).

BranchBanker creates a workstation designed to help serve customers in financial institution lobbies. This open-ended set of programs includes IRA sales and service, mortgage, CDs, all-savers, depreciation and amortization, loan payoff calculations and more than 75 other service aid modules.

Using a BranchBanker-type program, the service person can access the proper service module and depend on it for exact information about a service, have it request necessary information from the customer and carry out comparison studies to help the customer decide which of the alternative services best meets his needs.

BranchBanker runs on the IBM PC. A similar program, RB3, designed for both the Apple III and the IBM PC, is available from Aurora Systems, Inc. (2423 American Lane, Madison, WI 53704).

The use of the micro as a sales tool is developing in the areas of personal financial counseling, commercial customer financial analysis and agricultural decision analysis. Some financial institutions charge fees for the micro-based analytical counseling service, and others use it simply to increase the productivity and quality of their investment and lending services.

Whatever the area, micro-based sales-aid programs have proven themselves. The next steps already are being tested. They include micro-based robotic salesmen programmed to work directly with the customer. Some of these systems are even tied to video disks, so that the robotic salesman can illustrate its sales points and analysis with high-quality sight and sound scenarios selected from its repertoire.

The next step in this evolution is the use of such programs in the customer's home or office. At-home or in-office banking services via telephone or cable are already being developed, but they currently are limited to transaction processing.

How to Buy Bank Software

Micros are used in two ways by financial institutions: for accounting records and as personal decision aids. The criteria for selecting equipment and software varies, depending on the intended use.

For personal decision-aid use, the common strategy is "buy a computer and the software that you like." There are hundreds of good micros, and a personal computer (like a favorite pen) should "feel right" to the user. Of course, it also may be useful to obtain a machine and software that can interface with the business's other systems.

Calc Programs

As for software, executives usually begin by acquiring one of the popular "calc" packages, such as VisiCalc, SuperCalc, MultiPlan or 1-2-3. This approach is so popular that one of the best-sellers in this market is a collection of banking calc templates called "BankCalc" (published by MicroBook of Arlington Heights, IL).

As facility with micros develops, many executives obtain modems so they can use external databases and electronic mail facilities. And if they find that the calc program is not powerful enough, they often acquire Micro DSS/Finance or some other financial modeling system. Graphic programs, because of their power in depicting complex situations clearly, are also used extensively.

Of course, some decision situations are too complicated to warrant user-developed models. For these problems, the user generally will purchase a customized model designed for planning, budgeting, bond swap or pricing.

Micros Go Accounting

The use of the micro for accounting is a different situation. Applications such as general ledger, safe deposit, fixed asset or shareholder accounting are sometimes developed using some of the more powerful database programs, such as dBase II, Condor or InfoStar. Use of these tools and knowledge of the applications, though, does not always create a satisfactory program.

Programs designed to incorporate auditability, error prevention, help aids for operators, forced back-up records and recovery procedures are important in accounting applications. Therefore, good application software is often purchased or developed in conjunction with a trained systems programmer.

Low-volume applications, such as supplies inventory, personnel records, charge-off loan control records and charge-back routines (usually run under the users' direct control) are often user-developed.

When Buying Accounting Packages . . .

Because most of the major accounting programs are purchased, many factors should be considered. In the end analysis, the price of the software package may be the least significant factor; over the years, the costs of expansion, modification, error-correction and training may cost several times the initial software purchase.

Some of the factors that should be examined for any software purchase, but especially for accounting programs, are:

- *Source.* Will the vendor continue to support the system? How solid is his business? Is he dedicated to the industry and the application area? What support is available?
- *Flexibility.* Is the software expandable enough to take care of increased volume? Can the owner modify it as conditions change or must the developer make modifications? What are the conditions for modification? Can the software be used with a hard disk?
- *Control Features.* Does the software force audit-trail reports, control totals and back-up media? Does it have appropriate security features? What recovery procedures does it have to cope with process-interruption situations?
- *User Features.* Is the software easy to use? Does it have well-designed "help" screens? Does it have good error-trapping features? Is the speed adequate? What kind of training is available? What level of knowledge or skill is needed by the operator?
- *Compatibility.* Does the software utilize compatible equipment and operating systems? How well does it fit into the institution's current operating procedures? How well does it do the required job? And how well does it fit into the institution's long-range plans?
- *Documentation.* Is there adequate technical documentation? Is there a well-designed operating manual? Is there well-organized reference and troubleshooting material?
- *Sale Features.* What kind of license, sale and maintenance agreements are available? Can software be returned if it is unacceptable? What about multiple-site usage? How will bug fixes be handled? What warranties are included? Is the price competitive?

Roll With the Changes

In general, personal decision-aid micros are the responsibility of their users. Accounting micros are a part of the financial institution's formal information system. As such, they must pass muster with auditors, examiners and formal management practices.

Finally, the most important consideration is to realize that this is a dynamic field. All plans and acquisitions should be made with the full recognition that the ability to accommodate change may be the single most important feature of any hardware or software acquisition.■*R.L.*

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As micro-based interactive counseling programs develop, they'll lead to economical electronic financial counseling and consulting. Such services will be available whenever and wherever the customer desires.

Keeping Friendly

Another effective use of the micro as a sales aid is in the improvement of interpersonal communications.

One of the problems in selling financial services is knowing which service features are most important to the customer and how they should be presented. This is especially important as services become more complex and flexible.

To improve performance in this area, Personal Awareness Systems, Inc. (500 Park Blvd., Itasca, IL 60143), has developed a microcomputer-based program called Gameplanning. Banks and other institutions use it to help sales representatives and managers become more effective in selling ideas.

Gameplanning uses a microcomputer analysis of the customer and sales person's personalities to determine how differently they view the world. It then develops a game plan and coaches the sales representative on how to use his voice, posture, personal space and emphasis of selected service characteristics to communicate with the customer.

The next enhancement of this technique probably will involve the micro-based robotic salesman asking the customer questions, determining his personality and then tailoring its presentation to that particular customer.

It's even possible that, by giving the computer the proper sensors and programs, it might develop into a superior sales tool, since it could conceivably use voice frequency analysis, eye scan and other techniques to tell when a person was lying, when he was interested and when he was bored.

Cost Reduction

Microcomputers are also used to automate tasks too small or fast-changing to delegate to mainframe processing.

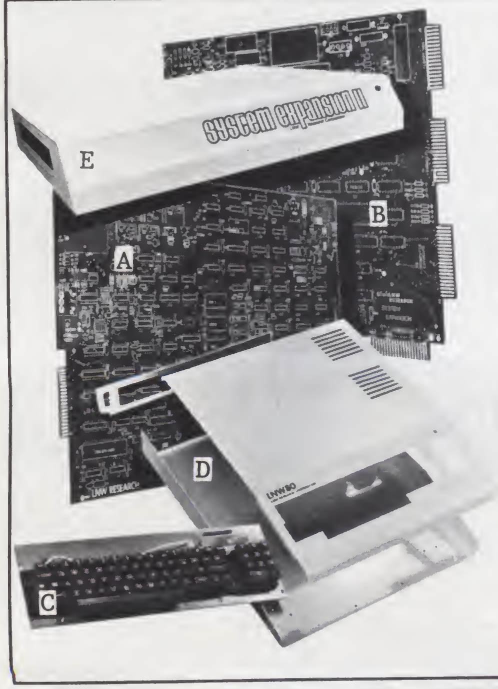
You can finance your home in more than 30 ways, and more schemes are being developed every day. Many of these contracts involve a lot of paperwork, calculation and constant updating; with tasks like this, a micro can be a miracle worker.

Loan documentation, follow-up tickler files, regulatory reporting, loan auditing, loan recalculation (after interest rates change) and other tasks work well on micros. And the systems can be constantly updated and improved by the loan officers themselves—the people who best know the regulations and requirements of the task.

Some financial institutions have found that, by using multiple workstations and hard disks, it's possible to put *all* of their processing on a micro. The Eagle State Bank in Eagle, NE, has developed a total on-line real-time banking system using a hard disk, a multiplexor and a number of Apple II computers.

A similar system built around a more powerful micro (such as an Altos, ONYX or IBC) with multiple user stations (using the Oasis operating system) has been developed by Orin Stevens in Dallas. These systems enable smaller financial institutions to cut their accounting and record-keeping costs to a fraction of what a mainframe data center would charge.

Micros also have been successful in



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replacing time-sharing services. Bankers have found that they often can replace a $1000-per-month time-sharing service with a $5000 micro. Amortized over five years, this amounts to a 90 percent reduction in that expense item.

Perhaps even more importantly, the executive has—with the micro—a model that he can modify, update and customize for maximum usefulness. VisiCalc, SuperCalc, Multiplan, Micro DSS-Finance and other powerful tools have proven their worth in this area.

Micros in Education and Training

Micros are just beginning to play an important role in financial education and training. So far, the use of traditional computer-based education programs has been limited. But there are some exciting capabilities developing.

Programs are being used to develop improved customer credit analysis skills, and asset/liability models are being used to teach improved senior management techniques and strategies. Simulations of trust departments, cash-flow, teller operations and check-processing operations are being used in the training of officers and employees.

In a sense, every decision-aid model and every sales-aid program is a functional and educational tool.

This is creating one of the most important effects of micros in the financial industry. Financial officers continue to tell our researchers that, "Now that the micro has made it so easy to calculate the probable results of different decisions, we have to work harder to learn to ask better questions."

Micro-based programs are, in effect, forcing the executives to become more precise, more creative and more sophisticated in developing strategies and plans. This is the most important long-range effect of micros in financial institutions; they raise the quality of decision-making.

Micro Challenges

Financial executives currently are wrestling with the following problems:

- *Micro support.* The cost of equipment and software is so low that most vendors cannot afford to supply significant on-site support. Yet, the large number of nontechnical users requires that wide-ranging education and support be available.

Some larger institutions solve this problem by developing internal education and support programs. This isn't feasible, however, for many of the other 40,000 smaller financial service institutions.

- *Coordination.* Whether there are five or 500 micros in an institution, there is a need for policies, procedures, controls and coordination. But if these rules are too tight, they may stifle experimentation and creative development. A number of developmental projects on how to solve this problem are under way. As these are completed, the results will serve as models that others can use to work out their own satisfactory solution.

It seems that the essence of this challenge is to determine how much the micro is used as a personal tool and how much it is used as a part of the institution's formal information system. The answers to these questions may be constantly changing ones.

- *Networking and mainframe integration.* In its original use, the micro was a stand-alone unit. But its users soon began to want to connect it to the institution's central processing system.

Technically, this has caused some problems and they are being solved. They lead, however, to another challenge: If micros become part of a distributed processing system, how do you prevent them from being used to subvert the system's data integrity?

- *Data security.* As large database-distributed systems are developed, the problems of control, confidentiality of data, misuse of data, ensuring data accuracy and even certification of appropriate program performance gain new importance. Financial institution auditors, security personnel and regulators are wrestling with these problems. It promises to be a never-ending struggle.

- *Obsolescence.* The life cycle of equipment, operating systems, application development tools and even programs has accelerated. The fast-changing micro industry places added emphasis on the importance of developing a balanced management philosophy for change.

Clear Concept Required

The basis for solving these challenges seems to lie in having a clear concept of the evolutionary development of computer systems. We are in the process of transferring individual and collective thought processes to a corporate "computer brain and nervous system."

The more capable we make this gigantic corporate robot, the more it can help us. But the more powerful it becomes, the more damage its misuse will cause.

Those who best solve the overall philosophy and design problems have the greatest opportunities to reap the tremendous long-range benefits of using the microcomputer to create a new level of financial service and efficiency.■

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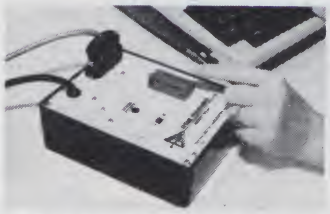

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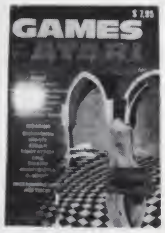

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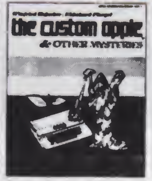

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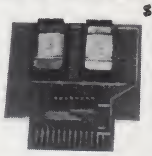

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Portability Plus

The Attache portable computer from Otrona offers a full-size Selectric-type keyboard; 5-½" (diagonal) CRT; two double-sided, double-density disk drives; 64K of RAM; and it's portable—something that can't be said for all so-called "portable" computers.

By Dave Smith

Good things come in small packages, they say. "They" must have been thinking of Otrona's Attache portable computer when coining that phrase. In fact, features abound in this compact and relatively lightweight machine.

For starters, take a look at the physical dimensions: a foot wide, six inches thick and less than 17 inches from base to top of handle in its carrying configuration.

These dimensions enclose a full-size Selectric-type keyboard, 5½-inch (diagonal) CRT, two double-sided, double-density disk drives and 64K of RAM—all weighing less than 18 pounds. Moreover, the machine is ruggedly housed in a high-impact plastic case which can actually be carried comfortably without tearing off an arm, or gouging a leg at each step; this a great improvement over its first-generation portable cousins, notably the Osborne 1.

The molded handgrip is comfortable even for trekking through those interminable airport boarding-gate corridors.

The handle serves a dual function in that it also pivots upon release to provide a two-position support for the CRT, giving the user some flexibility in viewing angle. With the handle folded back, the keyboard releases from the main body by means of two spring catches, and then folds back to separate from the computer housing. The keyboard connects electrically to the main body of the Attache by means of a standard 4-conductor modular telephone cable. The review unit came with both a long and a short cable, providing additional flexibility in arranging the components for maximum user comfort.

Power for the Attache comes primarily through a line cord, which must be carried separately, that connects to the rear of the main housing. Optional line cords and a convenient, externally accessible voltage adjustment card permit easy configuration of the computer for use in North America, the British Isles, Europe and Australia. Other options are a battery pack ($395) and dc adapter ($295). The currently available battery pack provides 1½ hours of operation, but a longer operation pack is expected to be available in the future.

Also located on the rear of the main housing are the two RS-232 serial ports for printer and communications devices. Additionally, there is a connector for an external video monitor, most likely a necessity for home-base operation. The built-in 5½-inch (diagonal) green phosphor CRT displays clear and sharp characters, but the 80-column by 24-line screen format demands small characters, which can become tiring on the eye after extended use.

The nearly standard Selectric-style keyboard contains 63 separate keys, including four cursor movement keys which are grouped at the bottom right for easy, one-hand operation. A sim-

Otrona's Attache is a high-quality, easily portable computer.

Address correspondence to Dave Smith, Box 55, Rindge, NH 03461.

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SYSTEM HARDWARE REQUIREMENTS
D&N-80 CPU, D&N FL470 or OSI 470 controller, 48K memory at 0000-BFFF, 4K memory at D000--DFFF, two disk drive cables.

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ple, two-key toggle converts the alpha keys under the right hand into the standard numeric keypad for rapid entry of numerical data.

The top row of keys, in addition to their number and symbol values, serve a variety of functions both in the system and display initialization, and in the operation of the WordStar word processor from MicroPro.

Directions for the special uses of these keys are imprinted on the surface of the keyboard, so they are always available for instant reference. In initializing the system and display, these keys control screen brightness, audio volume, audio tone, communications and printer baud rate, and the keyboard bell. Options for each of the controls are numerous. There is, for example, a choice of 11 baud rates—from 75 to 19,200 baud—for communication devices and the printer.

The two double-sided, double-density disk drives provide for a nominal 400K per disk storage capacity, approximately twice that of other portables. Coupled with the 64K of usable RAM, this disk capacity makes the Attache one of the most potent portable machines available.

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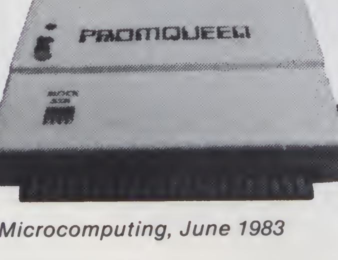

The Attache is truly a superior product which will satisfy any user determined to go first-class.

The Attache uses the CP/M operating system under license from Digital Research, and thus can access an enormous wealth of existing software. Locating the desired software on compatibly formatted disks might present an occasional problem, since there is no industry standard for 5¼-inch disks, but the fact that the Attache was designed for easy telecommunication should make both program and data transferral quite simple.

For those who enjoy creating their own programs, the Attache purchase price includes Basic-80 from Microsoft and a user's reference manual. This manual is for competent programmers, and doesn't claim to be an instruction book for learning to program in Basic. Sophisticated programmers will enjoy the speed with which programs are executed, the display is refreshed and disk I/O occurs. The speed is a function of the combination of 4 MHz Z-80A microprocessor and Am9517A coprocessor, the latter being dedicated to handling high-speed disk and serial port devices. There is also a dedicated 10K graphics memory and control to minimize response time.

As a word processor, WordStar by MicroPro International Corporation has received high acclaim. Included in the purchase price of the Attache, WordStar is easy to use, offering the advantages of minimal keystrokes for activating its many functions and providing a panoply of help screens so that the user is not constantly referring back to the instruction manual. WordStar supports (and the Attache displays as codes within the text) underlining, boldface, subscripts, superscripts, strikeouts, alternate character sets, multiple color printing and many other printing options.

Text editing on WordStar is also accomplished through multiple options for deleting, inserting and moving elements of text. For the sophisticated user, WordStar offers headings and footings, pagination, tabular columnization, automatic centering, decimal justification, hyphenization, internal (but not printed) comment lines and many other features.

The documentation supporting the Attache hardware and software is adequate and well-organized. Included in the review package were manuals for WordStar-Plus and Basic-80, together with Rodney Zaks' book, *The CP/M Handbook with MP/M*, plus various software licensing forms and agreements. The handbook for CP/M usage, while excellent in its thoroughness and clarity, was formidable in size (324 pp.). Otrona plans to issue its own CP/M manual in the future.

It was a personal joy for me to use the Attache. The compactness of the unit and the speed and elegance of its operation were particularly satisfying. I was slightly dismayed that the software included in my package did not permit experimentation with the graphics capabilities of the machine. The graphics software has since been released and is reportedly of the highest quality.

I find the price of the Attache and its accessories a bit steep in view of the competition's offerings. There is, for example, no spreadsheet software as is provided in the Osborne 1's purchase price. It is clear, however, that the Attache is truly a superior product which will satisfy any user determined to go first class in selecting a portable computer.■

A Capsule Look At Otrona's Attache

Manufacturer:
Otrona Corporation
4755 Walnut St.
Boulder, CO 80301

Base List Price:
$3995

Standard Features:
Z-80A (4 MHz) Microprocessor, Am9517A Coprocessor, 64K RAM, 10K dedicated graphics memory, 4K dedicated alphanumeric overlay memory, dual double-density, double-sided disk drives, five-inch green phosphor monitor (80 × 24 display), two RS-232 serial ports.

Proportions:
The system weighs 18 pounds. It is 12 inches wide, six inches thick and 17 inches from base to top of handle.

Software:
CP/M, Basic-80 and WordStar word processor.

Documentation:
Manuals for WordStar and Basic-80 and Rodney Zaks' book, *The CP/M Handbook with MP/M*.

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The Makings of a HERO

Build your own personal robot with the Heathkit HERO 1 kit.

By Mark J. Robillard

I'm kind of a robotics freak, so the announcement of the Heathkit Hero 1 personal robot was all I needed for an excuse to visit my local store.

Hero is a squat, gray mobile unit with a technical-looking arm hanging off the back of its neck. It contains everything you could want in a robot, so, having heard about Heathkit quality, I decided to give it a shot.

What You Get For Your Money

Ordering Hero wasn't easy. I bought one of the first models back in December. It was shipped directly to my home by United Parcel Service.

The reason it wasn't easy to obtain a Hero 1 was because the stores weren't ready for it. They are, however, ready now. In fact, I prefer buying from local stores rather than through mail order; that way, your unit will be delivered by someone who's just as interested in the product as you are.

The basic robot arrives in two rather large boxes. In the first box (they're all marked) you'll find the paperwork and documentation associated with the main robot.

Starting In

Inside the boxes are cardboard-separated compartments. Each one contains a kit of parts for some specific subsystem. (The instructions first warn you not to go crazy oohing and aahing over parts when you're unpacking the kit.)

Take my advice and build this one by the numbers. It's a complex kit—even the experienced assembler might get into trouble if he won't heed the warnings.

Before we get into the actual building of the kit, I'd like to mention a few things about the information supplied in the robot's documentation.

Documentation

You get a 233-page fully illustrated assembly manual for the main portion of the robot. The manual is a picture book of drawings that takes you step by step through even the most minute phase of construction. It includes drawings that show where a particular cable plugs in, as well as how you can trace a particular wire in the harness through all the bends and curves of the base unit; it's that detailed.

Assembly instructions are given in separate blocks with a place for insertion of a checkmark when you're done. At the end of each group is a crosscheck to assure completeness. With the instructions provided, you

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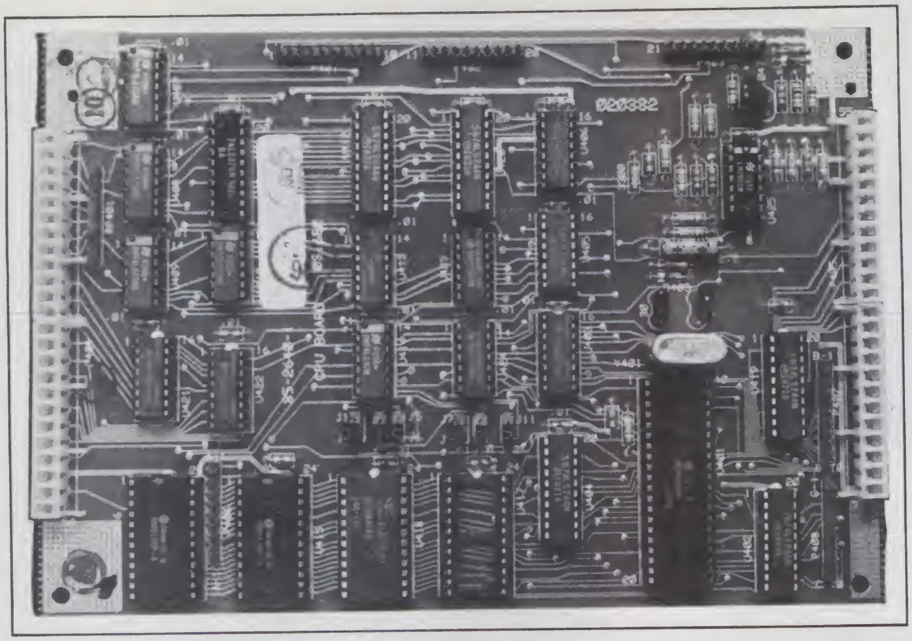

The brains behind the brawn. This is a view of the 6808-based CPU board.

Command Code	Command
02	Abort drive motor
03	Abort steering motor
04	Abort arm motors
1C00	Branch if base busy
1D00	Branch if steering busy
1E00	Branch if arm busy
1F00	Branch if speech busy
21	Zero
3A	Return to executive
3F	Change to robot language
41	Enable light detector
42	Enable sound detector
45	Enable sonar ranger
4B	Enable motion detector
4E	Enable display
51	Disable light detector
52	Disable sound detector
55	Disable sonar ranger
5B	Disable motion detector
5E	Disable display
6100	Speak, continue (indexed)
6200	Speak, wait (indexed)
71 mm mm	Speak, continue (extended)
72 mm mm	Speak, wait (extended)
83	Change to machine language (6800)
87 xx xx	Sleep (immediate)
8F xx xx	Pause (immediate)
BF mm mm	Jump if speaking (extended)
C8 ss xx	Motor move, wait absolute (immediate)
CC ss xx	Motor move, continue absolute (immediate)
D3 ss xx	Motor move, wait relative (immediate)
DC ss xx	Motor move, continue relative (immediate)
E300	Motor move, wait absolute (indexed)
EC00	Motor move, continue absolute (indexed)
F3 mm mm	Motor move, wait absolute (extended)
FC mm mm	Motor move, control absolute (extended)
FD mm mm mm mm mm mm mm	Motor move, All absolute (immediate)

Table 1. Listing of special commands with Hero robot.

really have to *try* to make a mistake.

Similarly, the user's guide and technical manual are fully illustrated. I'll go into both of these in more detail later.

Building the Boards

Fourteen PC boards make up Hero's electronics system. Each one is silkscreened—with component placement and numbering information—and solder mask protected.

The instructions provided in the assembly manual lead you component by component. You do not have to know the resistor color code, lead markings of transistors or how to orient electrolytic capacitors. Everything is provided for you.

Bypass capacitors for the boards and some of the more plentiful resistor values are provided on tapes that must be cut off, and you still have to bend the axial-leaded components.

Typically, the spacing is 0.5 inches, so if you could pick up a bending tool it would be helpful. There are a lot of components to bend.

Most of the boards are single-sided, so jumper wires are necessary. Here you'll find that you'll get a length of black hookup wire that you have to strip and bend. It would have been nicer if they had provided cut and preformed jumpers, but you asked for a kit, didn't you? Wherever manual labor enters the picture, it's do-it-yourself time.

Parts Quality

You'll find the boards extremely solderable and well-made. In fact, the electronic components for all the boards are high-quality parts. The CMOS ICs are individually packaged in yellow envelopes seated in conductive foam—not foil-covered styrofoam. The vendors used are the same that supply industry.

Basically, no schlock-house parts are included in the Hero.

It took approximately 25 to 30 hours of concentrated effort to complete the assembly of the boards alone (no, this is not a one-weekend project). The assembly manual instructs you to store these away while building the base mechanical assembly. When you do, make sure they are protected from static abuse. Most of these boards incorporate CMOS ICs, which are somewhat prone to destruction by static charges.

Mechanical Stability

The real "kit" aspects of the product

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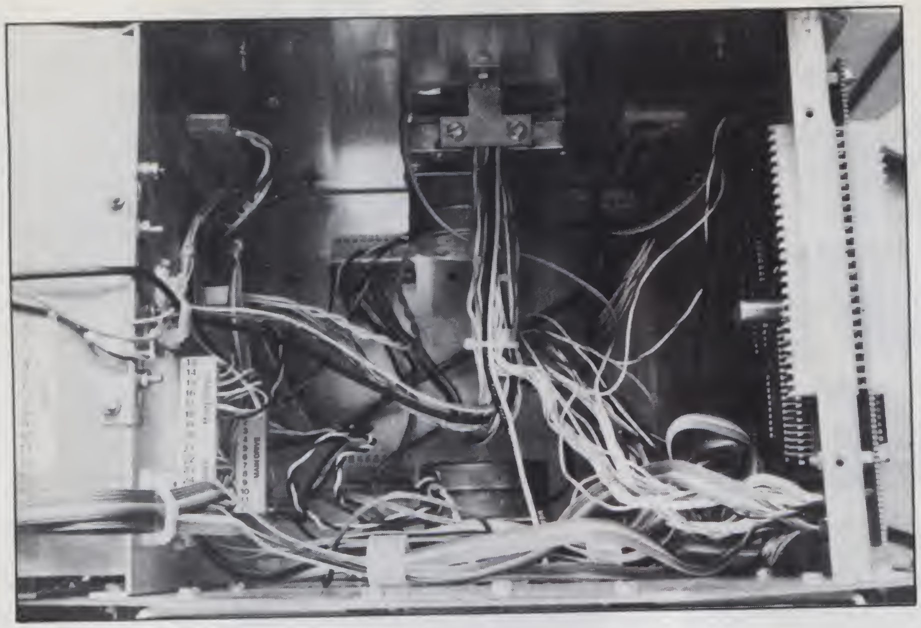

Inside view of the torso wiring. You get to build all those cables.

come out when you approach the mechanical end. You have to fit all 14 PC boards, wheels, motors, sides, headplates and a myriad of cables together before that first "ready" sounds out of Hero's mouth. What chances do you have of success?

Well, first of all, the assembly manual is just as detailed about mechanical assembly as it is about the boards. And Heath provides hard-to-find tools, such as allen wrenches and nut drivers.

I found that the mechanical pieces (e.g., sides, top and bottom plates) fit together properly. Most of the structural items are made of 1/8-inch aluminum and are sufficiently deburred and easy to work with. For the most part, I had no difficulties with screws, nuts or washers.

I did, however, have occasional shortage problems. A critical #8 set screw used to hold on the steering motor wheel was missing; so was a smaller one for the arm. Although this did cause some discomfort, a trip to the local hardware store and ten cents solved the problem. (Luckily, it was during store hours. There's nothing like uncovering a problem like that at 11 on a Saturday night!)

Cables, Cables and More Cables!

Do you enjoy making cables? I mean cutting wire to length, separating multiconductor ribbon cable into individual wires, stripping, crimping on the connector pins, adding a touch of solder (not too much) and then inserting the pin into the connector shell? For a ten-pin connector, all that work might be okay, but you'll have

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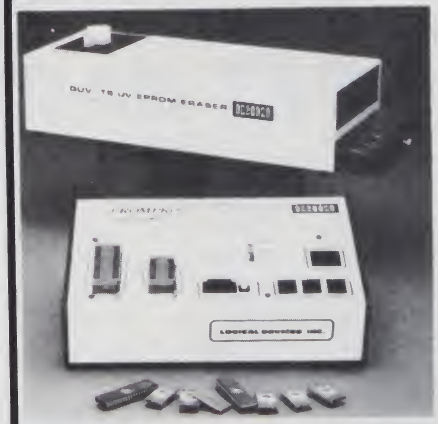

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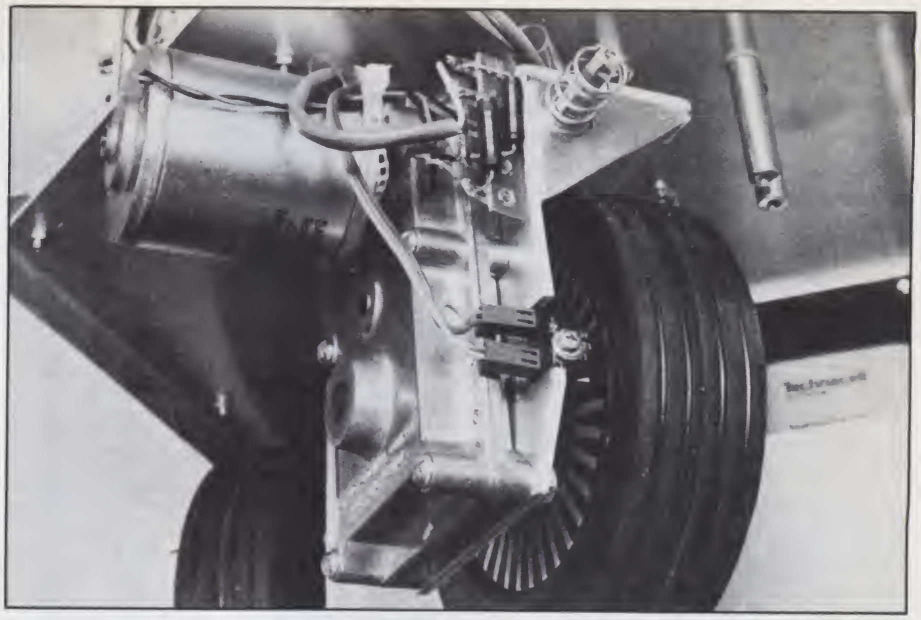

Closeup view of the main drive motor. The two cables are connecting the optical sensor used to sense position.

to do this to approximately 450 connections! Heath doesn't provide a crimping tool, and I assure you that, after you're done with all the cables, you'll be an expert!

The quality of materials and the directions for assembly of the cables, however, are excellent. Extra pins are included in case you make a few mistakes. Most of the cables are made using ribbon cable, but some are shielded.

I should mention that the kit includes three or four premade cables that come at a time in the assembly flow that one will most appreciate. (See photos for various stages of assembly.)

That First Power-On

After assembly, the manual instructs you to make an extensive "shorts" test of the power supply connections to each board. This test is done without the individual cards plugged in.

You repeat the test as each card is inserted on its connector. Should you run into trouble, the technical manual has circuit descriptions and a troubleshooting flowchart that should solve any problem.

I'm sure you're used to the flowchart that starts out being a power supply check. There are only two possible solutions: a bad pilot light or a blown fuse. You won't find this kind of flow with the Hero project; you're directed to chip-level servicing (all ICs are in sockets).

There is nothing like the anxiety one experiences that second before the power switch is turned on for the first

Circle 14 on Reader Service card.

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11055	24	4.98	$4.35	$3.90
11058	28	5.15	4.50	4.05
11057	40	6.81	5.95	5.35
11058	64	12.02	10.50	9.45

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22227	18	.29
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Stock No.	1-9	10 & Up
12098	$1.42	$1.28

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Stock No	Dia	Length (feet)	Weight (oz.)	Price
50075	.062	9	1.5	$1.16
50076	.062	25	4	2.39
50077	.062	50	8	4.25
50078	.032	33	1.5	1.31
50079	.032	88.5	4	2.47
50080	.032	175	8	4.57

TI WIRE WRAP SOCKETS
Tin plated phosphor bronze contact – 3 wrap

Stock No.	No Pins	1-99	100-499	500
11301	8	$.40	$.36	$.30
11302	14	.59	.54	.45
11303	16	.64	.58	.48
11304	18	.73	.66	.55
11305	20	.99	.90	.75
11306	22	1.12	1.02	.85
11307	24	1.25	1.14	.95
11308	28	1.52	1.38	1.15
11309	40	2.05	1.86	1.55

TI LOW PROFILE SOCKETS
Tin plated copper alloy 688 contact pins with gas tight seal.

Stock No.	No Pins	1-24	25-99	100-999
11201	8	$.10	$.09	$.08
11202	14	.14	.13	.12
11203	16	.16	.15	.14
11204	18	.18	.17	.15
11205	20	.20	.18	.16
11206	22	.22	.20	.18
11207	24	.24	.22	.20
11208	28	.28	.26	.25
11209	40	.40	.37	.33

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SINTEC Stock No. 300 MW Type	ELPAC No.	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (MA)	Dimensions (HxWxD) in Inches	Price
13825	CB3801	3.0-7.0	12±0.6	0-25	.48x.51x3.05	$ 7.95
13826	CB3811	3.0-7.0	-12±0.6	0-25	.48x.51x3.05	7.95
13827	CB3802	3.0-7.0	15±0.7	0-20	.48x.51x3.05	7.95
13828	CB3812	3.0-7.0	-15±0.7	0-20	.48x.51x3.05	7.95
13829	CB3804	3.0-7.0	28±0.7	0-10	.48x.51x3.05	7.95
13830	CB3814	3.0-7.0	-28±0.7	0-10	.48x.51x3.05	7.95
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13831	CL3801	4.0-7.0	12±0.6	125	.651x1.2x1.77	$24.95
13832	CL3811	4.0-7.0	-12±0.6	125	.651x1.2x1.77	24.95
13833	CL3802	4.0-7.0	15±0.7	100	.651x1.2x1.77	24.95
13834	CL3812	4.0-7.0	-15±0.7	100	.651x1.2x1.77	24.95
13835	CL3804	4.0-7.0	28±1.4	50	.651x1.2x1.77	24.95
13836	CL3814	4.0-7.0	-28±1.4	50	.651x1.2x1.77	24.95
13825-1	DATA SHEET FOR DC/DC CONVERTERS					.25

Stock No. 13801 – "Floppy Disc" Power Supply For Winchester Drives $109.00
13801-1 Data Sheet for 13801 ... .25

ELPAC POWER SUPPLIES – SOLV SERIES FULLY REGULATED

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13803	SOLV15-12	12	1.5A	4-7/16x4x2	Fixed included	39.95
13804	SOLV15-15	15	1.2A	4-7/16x4x2	Fixed included	39.95
13806	SOLV15-24	24	0.75A	4-7/16x4x2	Fixed included	39.95
13808	SOLV30-5	5	6.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13809	SOLV30-12	12	4.0A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13810	SOLV30-15	15	3.3A	5-5/8x4-7/8x3-3/16	OVP-4	59.95
13812	SOLV30-24	24	2.0A	5-5/8x4-7/8x3-3/16	OVP-4	58.65
13802-1	Data Sheet for SOLV Series					.25

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PIN FORMING TOOL puts IC's on their true row to row spacing. One side is for .300 centers, Flip tool over for devices on .600 centers. Put device in tool and squeeze.
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13298	20 pin
13299	22 pin
13300	24 pin
13301	28 pin
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13303	96 pin

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time. Will it explode? How will I pay for another?

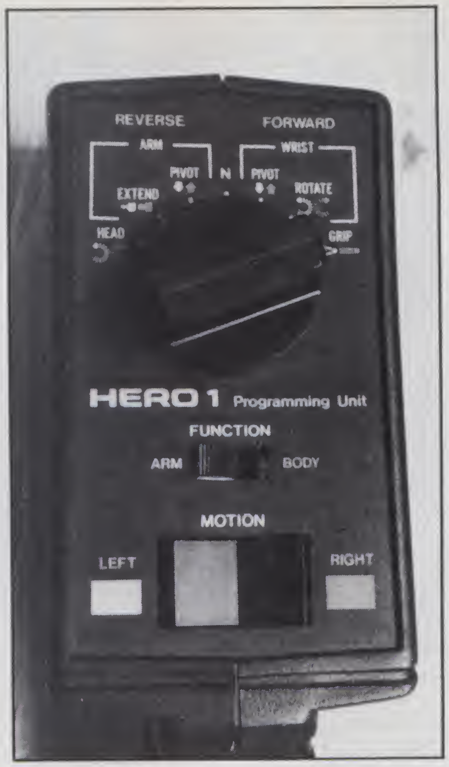
After following all the directions (well, maybe I cheated on a few), Hero came up running almost perfectly. ("Almost" is what I got for cheating.) I was surprised, considering all the possibilities for failure.

I had made one mistake—the steering motor was wired backwards, but this was easily fixed by reversing two two-pin connectors (that was one of the places I cheated).

A word to the wise: follow the directions, and after 50 or 60 hours you'll have a decent robot to experiment with.

Two manuals that come with the robot detail its operation. The user guide gives one program per sense (Hero senses time, light, sound, motion and distance) to check out the operation. Most of these programs are not useable in practical robot applications. Every time you want more information, it refers you to the technical manual.

In this book you'll find more detailed descriptions of each of the commands. At this point it may be beneficial to you if I list the capabilities that Hero has.



The handheld teaching pendant allows for easy programming of motion and lets you actually "drive" the robot.

You may not be aware of some of the exotic features. Basically, Hero is a personal computer on wheels.

Hero specs:

- 6808 microprocessor (6800 language)
- 8K control ROM
- Optional ROM socket (up to 8K×8)
- 4K CMOS RAM (almost all available to program)
- Real-time clock (uses the OK1 MSM 5832 RTC chip—battery backed-up)
- Cassette storage interface (Motorola format, cables included)
- Light sensor (light amplitude digitized to one of 256 levels)
- Sound sensor (sound amplitude digitized to one of 256 levels)
- Motion detector (ultrasonic circuit to detect changes in field of view)
- Sonar ranger (separate-frequency ultrasonic measuring system can resolute 256 distances from 0.4 inches to 8.6 feet)
- Hex keypad (for entering data and commands)
- Six-digit LED display (for displaying data)
- Handheld teaching pendant (more on this later)
- Four Gel cell power sources

HERO 1 Robot Programming Contest

Attention, HERO 1 owners! It's time for you to come to the fore. We know that you have been experimenting with your Heath robot. Now you have an opportunity to show us—and your fellow robot enthusiasts—what you have done.

What uses have you devised for your HERO 1 robot? *Microcomputing* wants to know, so, in conjunction with the Heath Company, manufacturers of the HERO 1, we are sponsoring a contest just for you.

Now's your chance to show off your robotics programming skill in the first ever *Microcomputing*/Heath HERO 1 Programming Contest. You'll have an opportunity to demonstrate your robotics knowledge and creativity in the following contest categories:

1. Standard HERO 1 with arm.
2. Modified HERO 1, including additional RAM or ROM, as well as any mechanical or electrical modifications.

The first place entry in each category will win a $500 gift certificate to be used toward the purchase of any product from the latest Heath catalog. We'll be awarding prizes to the top three entrants in each category.

Here are the details:

1. All programs must be submitted both on cassette tape and in hard copy form. A brief, written description of the application must accompany each entry.
2. Entries in the modified category must include a complete description of the alterations performed on the robot.
3. The contest is open to all HERO 1 owners, except employees of Wayne Green, Inc., and Heath Company and their immediate families.
4. All entries, including programs, become the property of *Microcomputing*.
5. All entries should include the name, address and telephone number of the author, and the category being entered.
6. All entries must be received by *Microcomputing* by September 1, 1983. Send submissions to:

Microcomputing
HERO 1 Programming Contest
80 Pine Street
Peterborough, NH 03458

Entries will be judged on originality and technical feasibility. While many entries will be designed to accomplish a specific application in a specific setting, the more universal and useful the program is, the better. All judges will be selected by *Microcomputing*.

Prizes:

First prize in each category will be a Heath $500 gift certificate. The winners will be able to select the prize of their choice, not to exceed $500, from the latest Heath Company catalog. Prizes for second- and third-place winners will be announced.

Winners will be announced in the December 1983 issue of *Microcomputing*.

For you non-HERO 1 owners, it's still not too late to purchase a unit, develop an application and submit it to the contest (you have over three months). And don't be intimidated if you've never worked with robots before. In a contest such as this, your creativity and imagination are the most important factors in determining the prize-winning applications. Let's put Heath's HERO through its paces.

- Switching power supply with low-voltage sensing
- Separate battery charger (ac powered)
- Head that turns 350 degrees (the light, sound, motion and sonar senses are mounted here).
- Steering drive wheel for turning
- Main drive system based on pulse width modulation for precise speed control

Options:

- Arm (with shoulder, extendable forearm, wrist pivot, wrist roll and gripper)
- Speech output using phoneme method (VOTRAX SC-01)

What more can you ask for? Well, Heath has several more extensions planned, so be assured that Hero won't be left unsupported.

The programming method for Hero is 6800 machine language. Heath has provided a number of preprogrammed subroutines for use by the programmer (see Table 1).

> Heath is big on ideas
> and short on instructions
> for applications.
> The programmer is left
> to fend for himself.

Operational Modes

Hero has two modes of operation: native (6800 language) and robot language. In the native mode, you write all commands in assembly language and execute them with the built-in monitor program. What robot language does for you is give you the ability to include predesigned, useful, robot-related routines in line with that assembly code.

If you're at all familiar with 6800 language, you'll notice that the commands listed in Table 1 are all (with the exception of 3F Software Interrupt) unimplemented op codes.

Robot language acts like an interpreter that takes in an op code, determines if it is special and acts on it. If it is a native code, it passes it off to the single-instruction step routine in the debugger for execution. Yes, it's slow, but you'll hardly notice the difference. The extra routines Heath has provided are worth the time.

Applications

This is where Heath is big on ideas

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Play the Blackjack rules of any major casino in the world!
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BLACKJACK MASTER	0450TS		$19.95	
GEO. EXPLORER:USA	0456TS		$19.95	
TEACHER	0455TS		$14.95	
MOUNTAIN PILOT	0452TS		$19.95	
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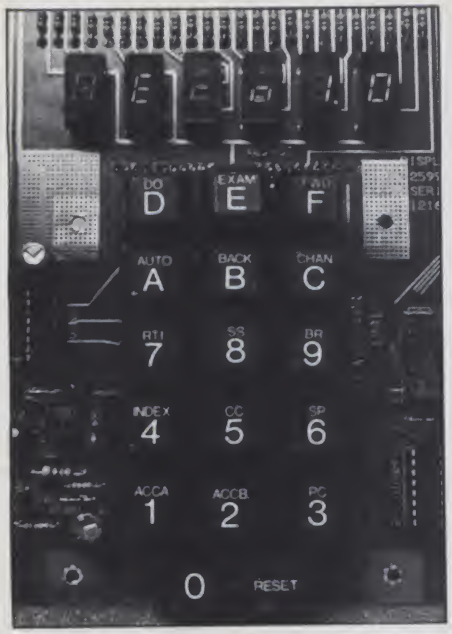
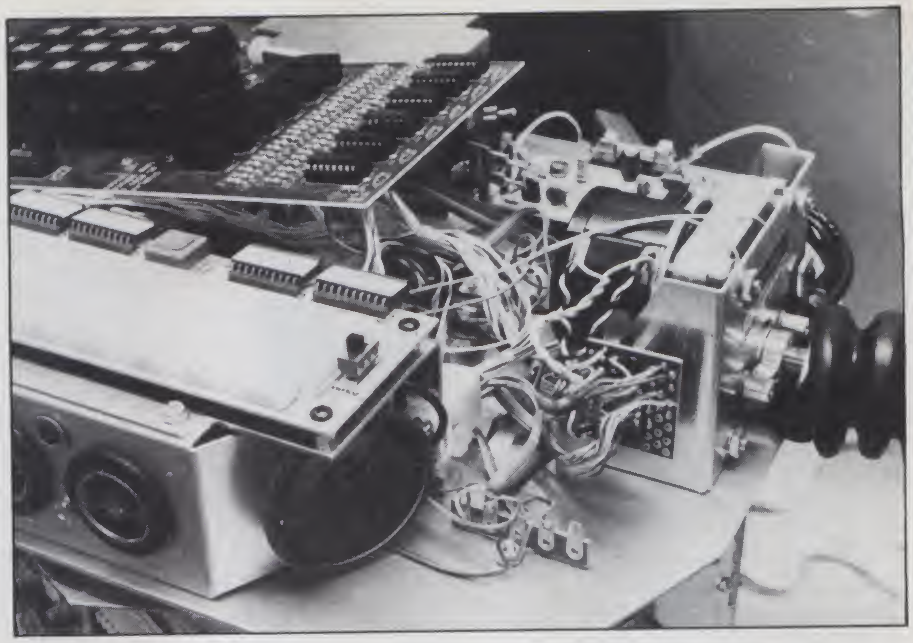


The 17-button keypad that becomes your link between man and robot.



Inside view of the head. The motor to the right is for the shoulder. Photo also shows the experimenter socket board, sound sensor microphone and display board.

and short on instructions. The novice programmer is really left to fend for himself. The technical manual provides only a list of 6800 op codes with no information on using them. "The Robot Course" (for an additional $100) does, however, provide an excellent reference.

You'll find the use of the teaching pendant helpful in programming motion. It's tough to determine distance by trial and error. There is a mode called LEARN whereby the programmer, using the pendant, can "drive" the robot while actual motion commands are being stored automatically in memory. Basically, it programs itself!

Where do you go from here?

Surprisingly, Heath has included a fantastic number of "hooks" that allow you to upgrade the robot both hardware- and software-wise. Some of these are not documented.

I have been researching Hero's innards for the past few months and have found them all, documented them and used them for hardware and software enhancements. You can obtain this information in the book *Hero-1 Advanced Programming and Interfacing* (catalog #22165, Howard W. Sams & Co., 4300 West 62nd St., Indianapolis, IN 46206).

Robot Wrap-up

The Hero is an excellent first pass at a personal robot. Almost anybody can build it, and, with a little help, almost anybody can program it.

For the hardware hacker, the Hero offers a myriad of circuits to explore. Software freaks will find the debugger above standard, with all the routines they can sink their teeth into.

Tired of playing video games with your Apple? Hero's the answer.■

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Z80 Software

SOFTWARE DESCRIPTIONS

TPM (TPM I) - $80 A Z80 only operating system which is capable of running CP/M programs. Includes many features not found in CP/M such as independent disk directory partitioning for up to 255 user partitions, space, time and version commands, date and time, create FCB, chain program, direct disk I/O, abbreviated commands and more! Available for North Star (either single or double density), TRS—80 Model I (offset 4200H) or II, Versafloppy I, or Tarbell I.

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This package provides all the necessary programs for customizing TPM for a floppy controller which we do not support. We suggest ordering this on single density (8SD).

Includes: TPM-II ($125). Sample PIOS (BIOS) SOURCE ($FREE). MACRO II ($100). LINKER ($80). DEBUG I ($80). QED ($150). ZEDIT ($50). TOP I ($80). BASIC I ($50) and BASIC II ($100)

$815 Value **NOW $250**

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Includes: TPM-II ($125). Sample PIOS (BIOS) SOURCE ($FREE). MACRO II ($100). MACRO III ($150). LINKER ($80). DEBUG I ($80). DEBUG II ($100). QSAL ($200). QED ($150). ZTEL ($80). TOP II ($100). BUSINESS BASIC ($200) and MODEM SOURCE ($40) and DISASSEMBLER *($80)*

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$680 Value **NOW $175**

MODEL II PROGRAMMER

This package is only for the TRS-80 Model II It includes: TPM-II ($125). BUSINESS BASIC ($200). MACRO II ($100). MACRO III ($150) LINKER ($80). DEBUG I ($80). DEBUG II ($100). QED ($150). ZTEL ($80). TOP II ($100). ZDDT ($40). ZAPPLE SOURCE ($80). MODEM ($40). MODEM SOURCE ($40) and DISASSEMBLER ($80)

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MACRO I - $80. A Z80/8080 assembler which uses CDL/TDL mnemonics Handles MACROs and generates relocateable code Includes 14 conditionals. 16 listing controls. 54 pseudo-ops. 11 arithmetic/logical ops. local and global symbols. linkable module generation. and more!

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$1280 Value **NOW $350**

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Includes: QSAL ($200). QED ($150). BUSINESS BASIC ($200). ZTEL ($80) and TOP II ($100)

$730 Value **NOW $300**

COMBO

Includes: DEVELOPER II ($1280). ACCOUNTING PACKAGE ($300). QSAL ($200) and 6502X ($150)

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When ordering software specify which disk format you would like.

CODE	DESCRIPTION
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8DD	8" Double Density (256 bytes/26 sectors/77 tracks)
8XD	8" CDL Extended Density (1024 bytes/8 sectcr/77 traceks 616K)
5SD	5.25" Single Density (TRS80 Model I. Versafloppy I. Tarbell I)
5EP	5.25" Epson Double Density
5PC	5.25" IBM PC Double Density
5XE	5.25" Xerox 820 Single Density
50S	5.25" Osborne Single Density
5ZA	5.25" Z80 Apple (Softcard compatible)

TPM INFO When ordering TPM I or II. in addition to Disk Format. please specify one of the following codes

	CODE	DESCRIPTION
TPM I:	NSSD/H	North Star Single Density for Horizon I/O
	NSSD/Z	North Star Single Density for Zapple I/O
	NSDD/H	North Star Double Density for Horizon I/O
	NSDD/Z	North Star Double Density for Zapple I/O
	TRS80-I	TRS-80 Model I (4200H Offset)
	TRS80II	TRS-80 Model II
	VI8	Versafloppy I 8"
	VI5	Versafloppy I 5.25"
TPM-II:	VII8	Versafloppy II 8" (XD)
	VII5	Versafloppy II 5.25"
	TRS80II	TRS-80 Model II (XD)

Prices and Specifications subject to change without notice.
TPM. Z80. CP/M. TRS80 are trademarks of CDL. Zilog. DRI and Tandy respectively.

ZTEL - $80. An extensive text editing language and editor modelled after DEC's TECO

ZEDIT - $50 A mini text editor Character/line oriented. Works well with hardcopy terminals and is easy to use Includes macro command capability

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ZDDT - $40 This is the disk version of our famous Zapple monitor It will also load hex and relocatable files.

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Circle 18 on Reader Service card.

Quality Printer For the QX-10

The QX-10 is one of the hottest systems to hit the micro marketplace in some time. Epson's latest printer, the FX-80, fits in nicely with this system, and is an improvement over the MX-80.

By Jim Hansen

It's finally happened. I'm in love with a computer system. I don't care if it is a Z-80, comes from Japan and isn't IBM-compatible. The QX-10 is a system that sits on the desk and says, "Come on, use me."

Part of what makes the QX-10 so appealing is the FX-80, Epson's latest printer. The FX-80, which sells for $699, is an updated version of the MX-80. It features all new electronics, a number of new printing features and higher throughput—and it's quieter than the MX-80.

Outside the FX-80

Externally, the FX-80 is a little larger than the MX-80; it measures 16¼ inches wide by 13½ inches deep by 3½ inches high. It has a slightly raised "rear deck" over the electronics area—reminiscent of early Mustangs.

The paper-feed path has been changed so that forms will enter the printer under a smoked plastic "separator" before being fed down into the mechanism, around a rubberized roller, past a tear bar and out the top of the printer.

The tear bar is a convenient feature; it allows paper to be torn about an inch above the current print position. The bar itself is stamped with a ruled scale to assist in aligning paper.

The FX-80 can print on single sheets, on roll paper (using friction feed) and standard fanfold paper stock between 9½ and ten inches wide. (Multipart roll stock is not recommended for this printer.)

An optional tractor assembly that rides on top of the printer is available for those who wish to print labels or other forms that will not fit the standard pinfeed platen.

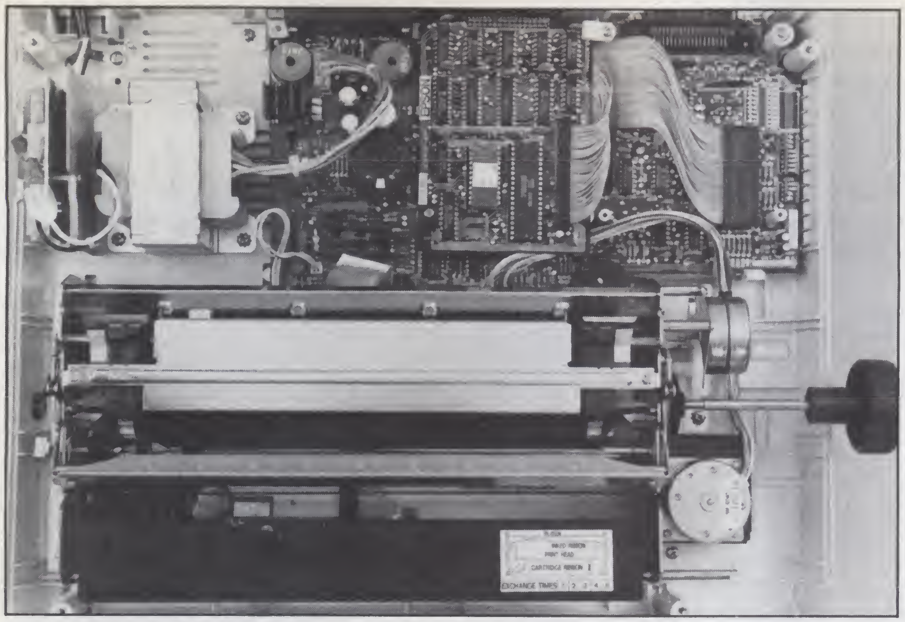
The plastic window of the MX-80 has been replaced with a shorter lid. The combination of this lid and the tear bar completely obscures the printing area from view; you can see the text printed about six lines above the head.

FX-80 Operation

Operationally, the FX-80 is quite similar to the MX-80. The control panel is still on the top right side of the case and the paper-feed knob is on the right side, but the power

Although slightly larger than the MX-80 printer, the FX-80 is similar in appearance. The power switch was moved from the right back corner to the left back corner. I considered this slightly inconvenient because both sides of the printer must be easily accessed—the left side for the power switch, the right for the printer knob. Paper enters the printer from the back, under the plastic "paper separator," and exits the top of the printer at about a 60-degree angle toward the back.

Address correspondence to Jim Hansen, Box 234, New Boston, NH 03070.



Top view of FX-80 with cover removed. Notice the power supply and ac switch on the left side of the case. A piggyback board is mounted in the middle of the controller and connected by a 40-wire cable. A rubberized roller platen adds friction feed capability and helps quiet the FX-80 printer.

switch has been moved to the left back side of the printer.

The manual cautions against using the paper-feed knob while power is on, but doesn't explain why. Whether the reason is because the printer will lose track of the form position (most likely) or because some form of mechanical or electrical damage could result, is not clear.

Two of the more noticeable differences between the FX-80 and MX-80 printers are speed and noise. The draft version of this review, consisting of 14,251 characters, took about 5½ minutes to print on the MX-80, and 4:26 on the FX-80. This represents a throughput of 43 characters per second for the MX-80 and 54 for the FX-80. (See Table 1 for actual throughput measurements.)

While I didn't get a chance to measure the noise level of the FX-80, it's substantially the quieter of the two. It also has a "quiet mode" to halve the printing rate, further reducing noise.

The noise reduction in the FX-80 is due primarily to the rubberized roller platen; there is no acoustical padding or other obvious noise suppression used inside the case.

Both the MX-80 and FX-80 take the same ribbon cartridge. The FX-80 claims a life of about three million characters. It has the same character fonts as the MX-80, including the italic font, and it supports nine character sets.

In addition to the ASCII set, the FX-80 has fonts for French, German, English, Danish, Swedish, Italian, Spanish and Japanese. All of these languages, except Japanese, can be selected automatically at power-on; any of them can be software-selected during operation.

The FX-80 also allows characters of your own design to be printed. This is done by sending character information to the printer, where it is stored in the "download character generator."

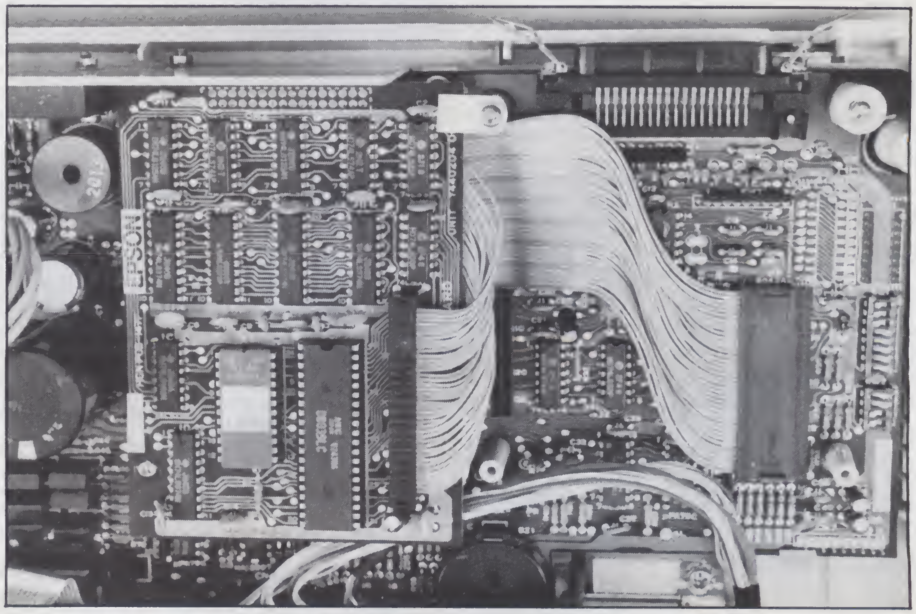
If only a few characters are to be changed, provision is made first to copy the existing character set in the printer into the download character generator. Then, only the new or different ones need be overlayed. This allows you to avoid having to design and send an entire character set to change one character.

Those who need to use unusual characters will find this feature invaluable. Previously, the only way to print new characters was to send them to the printer graphically. With the FX-80, they can be defined once at the beginning of a program or listing, and then printed as ordinary characters.

The manual spells out the procedure in 12 detailed pages with complete programming examples. While the character design procedure is complex, there is no reason why anyone, with the manual, couldn't get it to work.

Bit-image graphics are standard on the FX-80. Densities of 480, 960 and 1920 dots per eight-inch line can be selected. Since the printer uses an eight-inch line, this actually translates to 60, 120 and 240 dots per inch.

The 240 dot-per-inch mode has a limitation in that adjacent dots cannot be printed. In other words, this mode gives 1920 possible print positions, but a maximum of only 960 may be used.



A closeup view of the piggyback board. It would appear that this section of electronics was added late in the design stages of the FX-80. The logic here is to control the carriage motor and consists of a NEC 8039 microprocessor, a 2716 Eprom and a number of latches, flipflops and buffer chips. Also shown are the power-on option-select switches (along the right side) and the Centronics-compatible interface connector in back.

The 1920 dot mode is provided to allow smoother diagonal lines to be printed (it helps hide "staircasing"). Resolutions with much more than 100 dots per inch (dpi) aren't really useful (except for this application) because the printed dots become overlapped at 100 dpi or thereabouts.

The FX-80 also supports proportional spacing. When enabled by a three-character escape sequence, letters are spaced apart according to how wide they are, rather than by a specific fixed distance. This improves legibility and generally allows more characters to be printed on a line, but it can cause problems.

Unless the host computer knows how far the printer has spaced a line, it can't tell how much room is left before the right margin is reached. The answer, of course, is to give the computer a table of character widths, and let *it* worry about the ends of lines.

Inside the FX-80

Internally, the FX-80 is built much like the MX-80; it's totally modular, allowing for easy assembly. The mechanics area is bolted directly to the plastic base, as is a metal ground plane that supports the power transformer. The controller electronics is held to the cover base by a combination of screws in the base and catches molded into the case.

The printer electronics architecture is similar to the MX-80's, with two microprocessors (a 7811 and 8042) running in a master/slave configuration. One controller is dedicated to running the carriage motor, and the other handles all logical functions, I/O, the needles in the printhead and the linefeed motor.

Apparently, some design enhancements were made to the FX-80 that required more electronics. A piggyback board was added to replace the slave processor (it plugs into the 8042 slave socket). A third dip switch (SW 3) was not installed in the main circuit board, and no mention of it is made in the manual.

If downloaded fonts are not used, the FX-80 adds a 2K input buffer. This will free the host computer while the printer outputs the last 2000 characters sent to it.

Line Length (characters)	Measured Throughput (characters per second)
20	50
49	81
75	93
Mixed Length	61
Document (14,251 characters)	54

This table gives a sampling of actual throughput tests performed on the FX-80 printer. The first three tests consisted of 20 lines of text of the indicated length and timed to the nearest second. The mixed-length text printed a line of 20 characters, one of 49 and a third of 75 in that order, 20 times. The "Document" was an early draft of the FX-80 review, printed double-space in lines about 70 characters long. This is a "real" number and probably a typical printer application.

FX-80 Manual

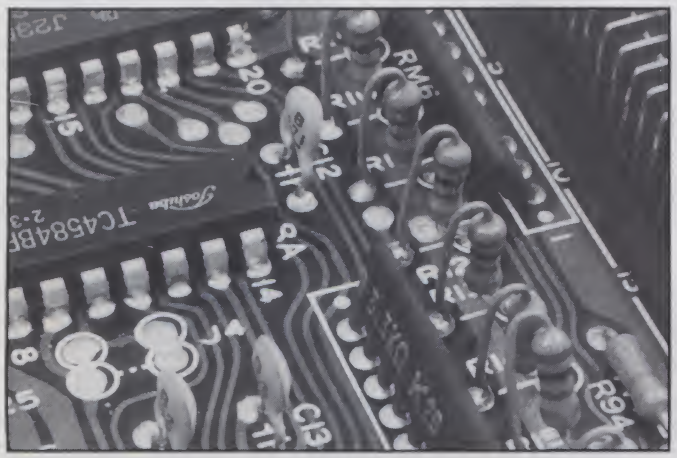
A well-written, wire-bound, half-inch-thick manual comes with the FX-80. It's not written in the folksy manner of the MX-80's manual; instead, it's direct, concise and written in clear technical style. A sample program, written in Basic, demonstrates every command at least once.

In the main part of the manual, a full page (or more) is devoted to each command. Eight appendixes provide details on optional tractor installation, interface connections and timing, character font patterns and more. The last appendix provides a convenient control code summary arranged by function, with page references for details.

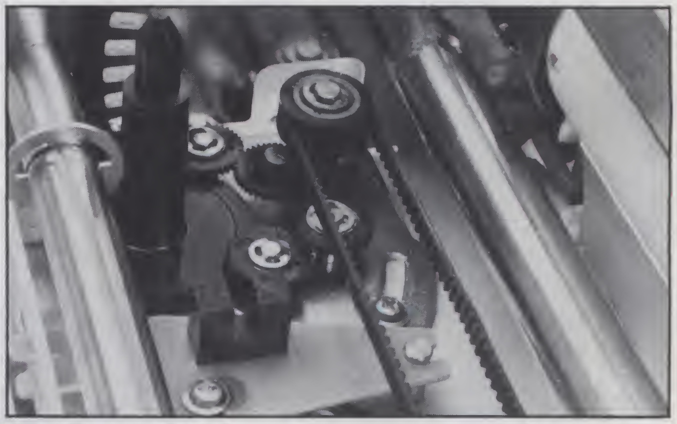
Subjective Comment

I found the FX-80 to be much improved over the MX-80 in both design and performance. It's not only faster and quieter but, when word processors begin to support the proportional spacing and downloadable character features, it should be more versatile.

Another important improvement is that all character modes, including graphics, can be printed on the same line. In the MX series of printers, modes could not be switched in the middle of a line, so "fancy" lines had to be carefully planned ahead. This sort of problem doesn't exist with the FX-80.

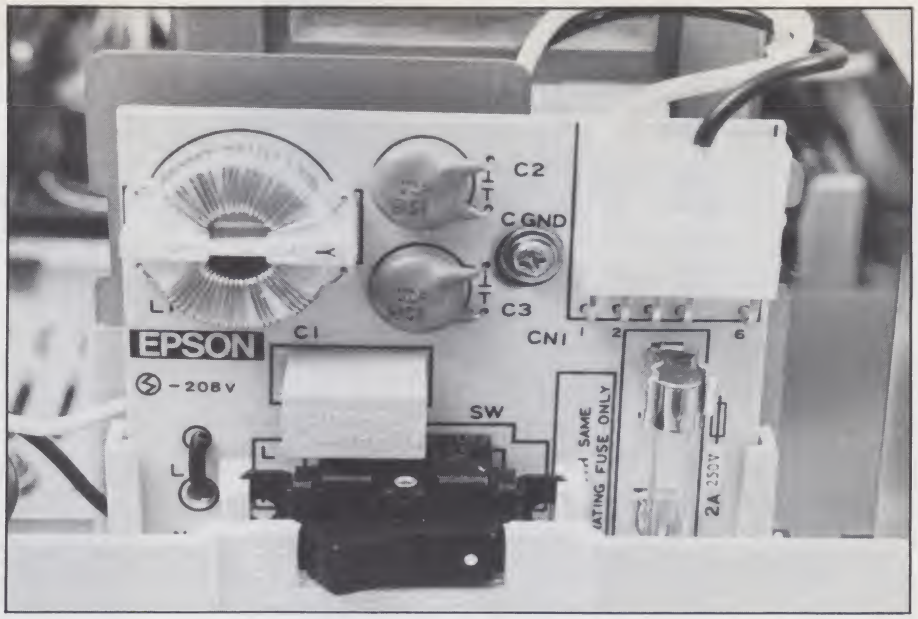


Epson chose to mount many of the discrete components vertically, like transistor radios often do. The resistors shown here are located just behind the I/O connector. The resistor bodies and wire leads have been conformally coated to prevent electrical shorts should they touch. This type of assembly is not often used in digital equipment.



The left side of the printer showing the left margin sensor, ribbon drive and carriage belt. Power to drive the ribbon cartridge is taken from the belt, the same as in the MX-80. Notice the pin-feed tooth projecting through the paper. If paper is not carefully removed from the printer, scraps not easily removable can be left in the lower region of the feed path, making it difficult or impossible to reload.

Overall, I would rather use the FX-80 than the MX-80—mainly because of its increased speed and lower noise.



This is the ac line filter and switch, located on the left side of the FX-80 printer. Notice the exposed fuse holder (which would be electrically hot during operation). The FX-80 is UL-listed.

Naturally, I have a few gripes about this product. Paper-loading, for whatever reason, is a perennial problem with nearly all low-cost printers, including this one. There seems to be no easy way to get paper, either perforated stock or single-sheet, into the printer.

I found that the best way to start perforated stock was to double over the first sheet. One side of the paper often will engage the sprockets before the corresponding sprockets on the other side of the paper—usually one hole off. Unless you pay attention, you'll crank the paper around and not discover the problem until the sheets come out askew.

The first time this happened to me, I wasn't careful about removing the jammed paper, and some of the perforated edges were left in a pinfeed assembly, down where it couldn't be seen. I spent more than ten minutes clearing the jam. (You can't see or do much in the pinfeed area with the cover on.)

The FX-80 also likes to "eat its tail." By this I mean that paper, coming out the top, has a propensity for going back into the bottom for a second time through. The paper separator should be extended toward the back with a lip that stops and helps stack the paper coming from the printer.

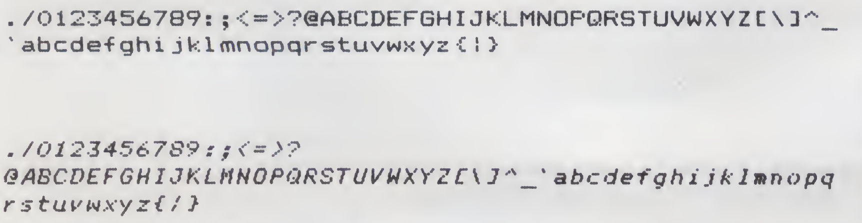
If your paper supply is located behind the printer on the table top, the FX-80 cannot print unattended unless special arrangements to handle the output have been made. (Paper also sometimes flops over the front of the printer and falls to the floor, but this isn't so much of a problem.)

I liked the FX-80's quieter operation and its speed improvement over the MX-80, although the slow linefeeds (the FX-80 takes seven seconds to perform a full page top of form) still limit throughput performance. Until Epson installs a linefeed motor powerful enough to move paper without all the reduction gears, throughput will be considerably lower than it should be.

Ribbon life, another problem with many low-cost printers, seemed shorter than it should be. I used the FX-80 and a brand new ribbon to print the draft and final copies of this series of reviews, along with three other manuscripts. The print is now so grey that I'm about ready to change the ribbon.

Overall, I would rather use the FX-80 than the MX-80—mainly because of its increased speed and lower noise. And the FX-80's print quality is about the same as the MX-80's.

As a system printer for the QX-10, the FX-80 is a compromise. It offers print quality and data rates that only hint at potential QX-10 applications and performance. But it should be mentioned that the Valdocs system supports the FX-80, and any other printer would probably limit some aspect of hard copy output from Valdocs.■



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./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
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./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
rstuvwxyz{/}
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Fig. 1. Print sample from FX-80 printer. These are the "normal" fonts, and are the same in general appearance as those printed by the MX-80 printer.

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Micro Software Digest

Compiled by Swain Pratt

Micro Software Digest presents capsulized software reviews from various computer-related publications.

Programmers Toolkit and Graphics Kit

System Requirements: Timex/Sinclair 1000 or Sinclair ZX-81; 16K RAM
Manufacturer: Softsync, Inc., PO Box 480, Murray Hill Station, New York, NY 10156
Price: $14.95 each or $25 for both
Comments: Programmers Toolkit and Graphics Kit are compatible utility programs for Timex/Sinclair computers. According to the review, eight utilities and 23 graphics routines are provided. Among the most useful utilities in Toolkit are Renumber, Search and List, and Search and Replace.

Graphics Kit gives you a "wealth of useful routines," says the review. While it doesn't have high-resolution capability or permit you to create your own character set, it does "allow you to define your own multicharacter shapes, and to draw or erase them anywhere on the screen."
Reader Service number 414

(Reviewed in COMPUTE!, *March 1983)*

MatheMagic

System Requirements: IBM PC
Manufacturer: International Software Marketing, Ltd., Suite 42, University Building, 120 East Washington Square, Syracuse, NY 13202
Price: $99.95
Comments: MatheMagic turns the IBM PC into a supercalculator, according to the review, enabling you to perform many complex calculations, to write, store, retrieve and edit formulas, and to deal easily with extensive mathematical data.

"MatheMagic," says the review, "is at once extremely easy to use, yet deceptively powerful. It can calculate anything from the area of a circle to launch trajectories. In short, you can do just about anything that involves manipulating numbers."
Reader Service number 405

(Reviewed in REFERENCE, *January/February 1983)*

The Stock Market Calculator

System Requirements: Timex/Sinclair 1000 or Sinclair ZX-81; 16K RAM
Manufacturer: Softsync, Inc., PO Box 480, Murray Hill Station, New York, NY 10156
Price: $14.95
Comments: According to the review, the primary function of The Stock Market Calculator is "to help the investor (or user) solve the complex equations inherent in Investment Analysis."

"Besides the fairly well-written programs contained in this package," the review concludes, "users will find that the documentation is also excellent."
Reader Service number 415

(Reviewed in SYNC, *January/February 1983)*

A Financial Wizard

System Requirements: Atari 400 or 800; 810 disk drive; at least 24K RAM; printer optional (Epson with Graftrax, NEC, Prowriter or Centronics 739 are compatible)
Manufacturer: On-Line Computer Center, 10944A North May Ave., Oklahoma City, OK 73120
Price: $59.95
Comments: "If you want to use a financial system," says the review, "but don't want to spend several days trying to learn to use one, then A Financial Wizard may be just what you need." Along with a clear, thorough, illustrated manual, the program offers several routines, including Check Entry, Budget Entry, Checkbalancer and Checkwriter.

"Overall," the review concludes, "this is an excellent finance system—entertaining, accurate and fun to use."
Reader Service number 409

(Reviewed in COMPUTE!, *January 1983)*

Spellbinder

System Requirements: Z-80-based computer; CP/M, MP/M or Oasis; 48K RAM; printer
Manufacturer: Lexisoft, PO Box 267, Davis, CA 95616
Price: $495
Comments: Spellbinder, according to the review, is a very powerful and flexible word processing program, with features that make office management easy. "The office management features," says the review, "speed up things like forms fill-in and preparing of personalized form letters."

The review states that "Spellbinder is not a page-oriented processor, so the screen may be rewritten with new margin lines, and printing can use margins that you set." The review concludes that the manual is thorough, clear and well-written.
Reader Service number 406

(Reviewed in Interface Age, *January 1983)*

Vu-Calc

System Requirements: Timex/Sinclair 1000; 16K RAM
Manufacturer: Timex Computer Corp., Waterbury, CT 06725
Price: $19.95
Comments: Vu-Calc is a spreadsheet program for the Timex/Sinclair 1000. In such a program, says the review, "we expect to be able to handle budgeting, to work out complex mathematical problems, and to have the flexibility to calculate compound interest tables and record the answers."

The review states that Vu-Calc fulfills these requirements, and concludes that the program "is potentially a valuable tool for many owners. . . the jobs to which Vu-Calc may be assigned are limited only by the creativity and imagination of the user."
Reader Service number 418

(Reviewed in SYNC, *January/February 1983)*

Desktop/Plan

System Requirements: IBM PC; PC-DOS; 64K RAM; one disk drive; IBM or serial printer, IBM with Graftrax
Manufacturer: VisiCorp, 2895 Zanker Road, San Jose, CA 95134
Price: $245
Comments: This program, according to the review, is better suited than VisiCalc to office uses. "Desktop/Plan produces nicely formatted reports . . . with flexible column and row headings. It can also produce business graphics, such as bar charts or line graphs."

The review concludes that "Desktop/Plan is a nice package for someone unfamiliar with computers who just wants to get the job done."
Reader Service number 419

(Reviewed in InfoWorld, *January 3, 1983)*

Move-it (Version 3.0)

System Requirements: Any CP/M-based computer; 32K RAM; one disk drive; RS-232 serial communications port
Manufacturer: Woolf Software Systems, 23842 Archwood St., Canoga Park, CA 91307
Price: $99
Comments: The review states that Move-it "gives CP/M computers almost all of the desirable smart-terminal features. It allows the transmission of disk files . . . and the movement of received data to a disk."

"Move-it is a capable program," the review concludes, "with several excellent features. It doesn't add anything to the state of the art, but it is a well-integrated package for the CP/M user."
Reader Service number 420

(Reviewed in InfoWorld, *January 3, 1983)*

Money Decisions, Volume I

System Requirements: IBM PC; PC-DOS; 64K RAM; one disk drive; monitor/adapter
Manufacturer: Eagle Software Publishing, 993 Old Eagle School Road, Wayne, PA 19087
Price: $199
Comments: "Money Decisions," says the review, "doesn't do anything that a good financial calculator can't do, but it does it without the need to master a complex calculation sequence or a convoluted notational system." Volume I performs 34 investment, loan and business management functions.

Although it is poor on error messages, according to the review, "if you're tired of battling your financial calculator, you will find this program a refreshing change."
Reader Service number 403

(Reviewed in InfoWorld, *January 3, 1983)*

SuperCref

System Requirements: IBM PC; PC-DOS; 64K RAM; one disk drive
Manufacturer: The Write Ring, 5050 Garford, Suite 160, Long Beach, CA 90815
Price: $25
Comments: According to the review, "SuperCref is a cross-referencing program for Basic, Basic A and compiler Basic languages on the IBM PC." Such a program checks the source code of a program and lists all occurrences of language symbols and their references in the program, thus providing a valuable tool for programmers.

"Overall," concludes the review, "the program is fast and efficient. It takes up very little space on a disk, allowing you to fit it onto a programming work disk with no problem. It is also easy to use."
Reader Service number 421

(Reviewed in Softalk for the IBM Personal Computer, *Nov., 1982)*

Word/PC

System Requirements: IBM PC; PC-DOS; 64K RAM; one disk drive
Manufacturer: Computer Software Technology, 9818 West Belleview Ave., Box 5049, Littleton, CO 80123
Price: $89.95
Comments: Word/PC, according to the review, is an easy-to-use word processor for basic text entry and editing. "Word/PC is page oriented," says the review. "You may use any page format that utilizes a maximum of 80 characters per line, 66 lines per page."

The review concludes that the documentation is not easy to follow, but "the program is a simple, economical, straightforward piece of software that incorporates the features necessary to do routine word processing and allows expansion to more powerful capabilities at extra cost."
Reader Service number 402

(Reviewed in Softalk for the IBM Personal Computer *Nov., 1982)*

Super-Text 40/56/70

System Requirements: Apple II or II Plus; one or two disk drives
Manufacturer: Muse Software, 347 North Charles St., Baltimore, MD 21201
Price: $125
Comments: This program, according to the review, "is far and away the best word processing package for the money on the market today . . . Apple owners who have yet to find the money to lay down for an 80-column board will be elated with this rendition of Super-Text."

The review concludes that "this is a powerful piece of word processing software—suitable for both business and personal applications."
Reader Service number 407

(Reviewed in Interface Age, *January 1983)*

Ultima II

System Requirements: Apple II; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: Sierra On-Line, 36575 Mudge Ranch Road, Coarsegold, CA 93614
Price: $59.95
Comments: Ultima II, says the review, "sparkles with speed and superb graphics . . . Like the original Ultima, part of the game takes place in the far-flung future in space. The story revolves around your search for Mondain's evil apprentice, Minax."

The review concludes that "Ultima II is a universe of enchantment and challenge that draws you deeper into its unique spell with each playing. It will provide many hours, possibly months, of delight and enjoyment."
Reader Service number 413

(Reviewed in Softalk, *January 1983)*

PFS: Graph

System Requirements: Apple II or II Plus; SOS and Apple DOS 3.3; 128K RAM (64K for Apple II); two 5¼-inch drives
Manufacturer: Software Publishing Corp., 1901 Landings Drive, Mountain View, CA 94043
Price: $175
Comments: This program, according to the review, generates up to four-at-a-time simple color or black-and-white graphs, and you can customize the display with names and labels.

"You can display your data," says the review, "in the form of a pie, bar or line graph . . . Certainly there are other graphic generators for Apples that can do much more than PFS . . . but they cost quite a bit more, and none is as easy to use as this program."
Reader Service number 416

(Reviewed in InfoWorld, *March 14, 1983)*

THE Spreadsheet

System Requirements: Apple II; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: A.P.P.L.E., 304 Main Ave. South, Suite 300, Renton, WA 98055
Price: $22.50 for A.P.P.L.E. members. Otherwise, add $25 for membership (program sold only to members)
Comments: Apple PugetSound Program Library Exchange (A.P.P.L.E.) has brought out—for club members only, but anyone can join—a spreadsheet program which is inexpensive and, according to the review, "does more than the original VisiCalc . . . anyone new to spreadsheets will be suitably awed by the power and performance of the package." Reader Service number 401

(Reviewed in Softalk, *January 1983)*

Data Capture/pc

System Requirements: IBM PC; PC-DOS; 64K RAM; one disk drive
Manufacturer: Southeastern Software, 7743 Briarwood Drive, New Orleans, LA 70128
Price: $120
Comments: "Data Capture/pc is a sophisticated and easy-to-use communications package," says the review. While considering Data Capture/pc "an excellent, thoroughly professional communications program," the review concludes that it is "not a good value for the money . . . Other programs of equal quality and ease of use are available at less than one-fourth the cost." Reader Service number 417

(Reviewed in Softalk for the IBM Personal Computer, *Nov., 1982)*

Superfile

System Requirements: Z-80-based system with CP/M or MP/M, or IBM PC with MS-DOS; 64K RAM; two disk drives or hard disk; CP/M-compatible word processor
Manufacturer: FYI, Inc., PO Box 10998, #615, Austin, TX 78766
Price: $195
Comments: "Superfile," says the review, "is a low-cost alternative to a data-base management system. It is a filing system . . . [which] relies heavily on your word processor to prepare the records and on your operating system (and you) to find them."

Superfile is good for storing—and locating—complete documents that have been entered, but does not handle abstracted information like a database. "This program," concludes the review, "is suited to certain uses, and I recommend you analyze your situation carefully to see if it can fit your needs."
Reader Service number 404

(Reviewed in InfoWorld, *March 14, 1983)*

DOS Enhancer

System Requirements: Apple II or II Plus; DOS 3.3; 48K RAM and both Applesoft and Integer Basic; one or two disk drives; language/RAM card is optional
Manufacturer: S&H Software, 58 Van Orden Road, Harrington Park, NJ 07640
Price: $69
Comments: "The DOS Enhancer," says the review, "is a complete rewrite of . . . Apple DOS 3.3 . . . designed to increase the efficiency of the standard Apple DOS, especially when you are running and saving files written in binary language, Applesoft Basic and Integer Basic."

This program, concludes the review, "is a worthwhile product for most computer users. Novice users can easily make their systems work faster, while advanced programmers can take advantage of the program's extra added features. The DOS Enhancer offers excellent value for its price." Reader Service number 412

(Reviewed in InfoWorld, *March 14, 1983)*

Checkers

System Requirements: Apple II; 48K RAM; ROM Applesoft; one disk drive
Manufacturer: Odesta, 930 Pitner, Evanston, IL 60202
Price: $49.95
Comments: "If you're looking for a way," says the review, "to learn the ins, outs, hows and wherefores of the game, Odesta's Checkers can provide you with voluminous help and insights."

"Checkers is not just a game," states the review. "It's a textbook tutorial on a disk that includes games as a way to try out what you've learned from the manual."
Reader Service number 408

(Reviewed in Softalk, *March 1983)*

The Quick Brown Fox

System Requirements: VIC-20 or Commodore 64; printer
Manufacturer: Quick Brown Fox, 548 Broadway, Suite 4F, New York, NY 10012
Price: $65
Comments: The Quick Brown Fox is a word processor in cartridge form, which, according to the review, "uses a simple system of menus and prompts to guide the user through the difficulties in producing professional text."

It "is easy to use," concludes the review, "and costs less than many word processors with similar features." The program is recommended "especially for those users with limited word processing experience, but advanced word processing needs."
Reader Service number 411

(Reviewed in COMPUTE!, *April 1983)*

Paper Clip

System Requirements: PET/CBM; Basic 4.0; 32K RAM; Commodore disk drive; (an included ROM chip must be installed before the program will work)
Manufacturer: Paper Clip, 71 McCaul St., Toronto, Ontario, Canada M5T 2X1
Price: $125
Comments: The review states that "Paper Clip is a very powerful word processor, with so many features that most people will need only a fraction of them . . . As with most word processors, you can correct text on the screen and move it easily from place to place."

The program includes several unusual features, has a good manual and supports a wide range of printers, according to the review.
Reader Service number 410

(Reviewed in COMPUTE!, *April 1983)*

COMPUTE!, published by Small System Services, Inc., PO Box 5406, Greensboro, NC 27403.

Infoworld, published by Popular Computing, Inc., 375 Cochituate Road, Box 880, Framingham, MA 01701.

Interface Age, published by McPheters, Wolfe and Jones, 16704 Marquardt, Ave., Cerritos, CA 90701.

REFERENCE, published by Constant Communications, Inc., PO Box 1200, Amherst, NH 03031.

Softalk, 11160 McCormick St., North Hollywood, CA 91601.

Softalk for the IBM Personal Computer, 11160 McCormick St., North Hollywood, CA 91601.

SYNC, published by Ahl Computing, Inc., 39 East Hanover Ave., Morris Plains, NJ 07950.

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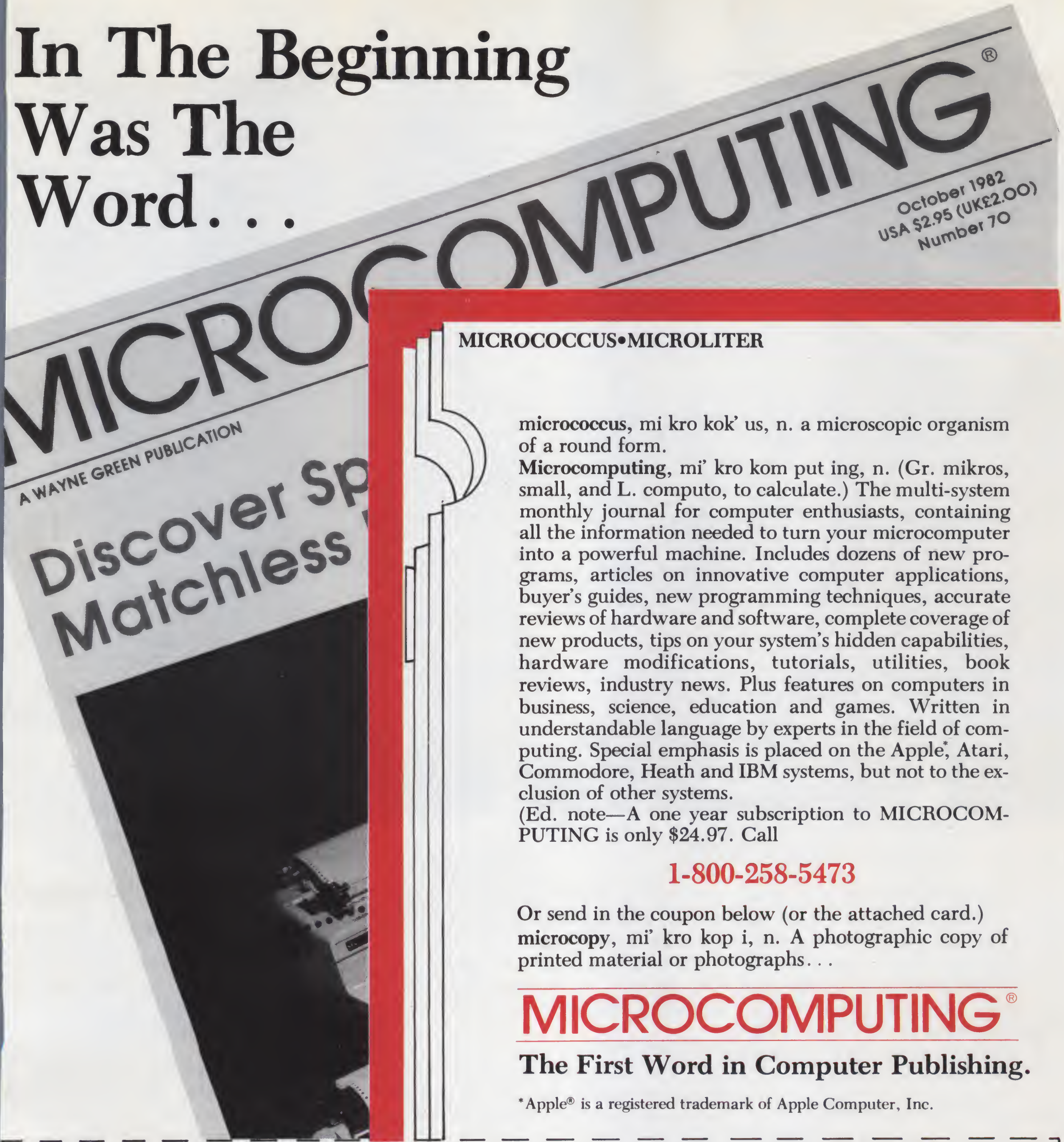

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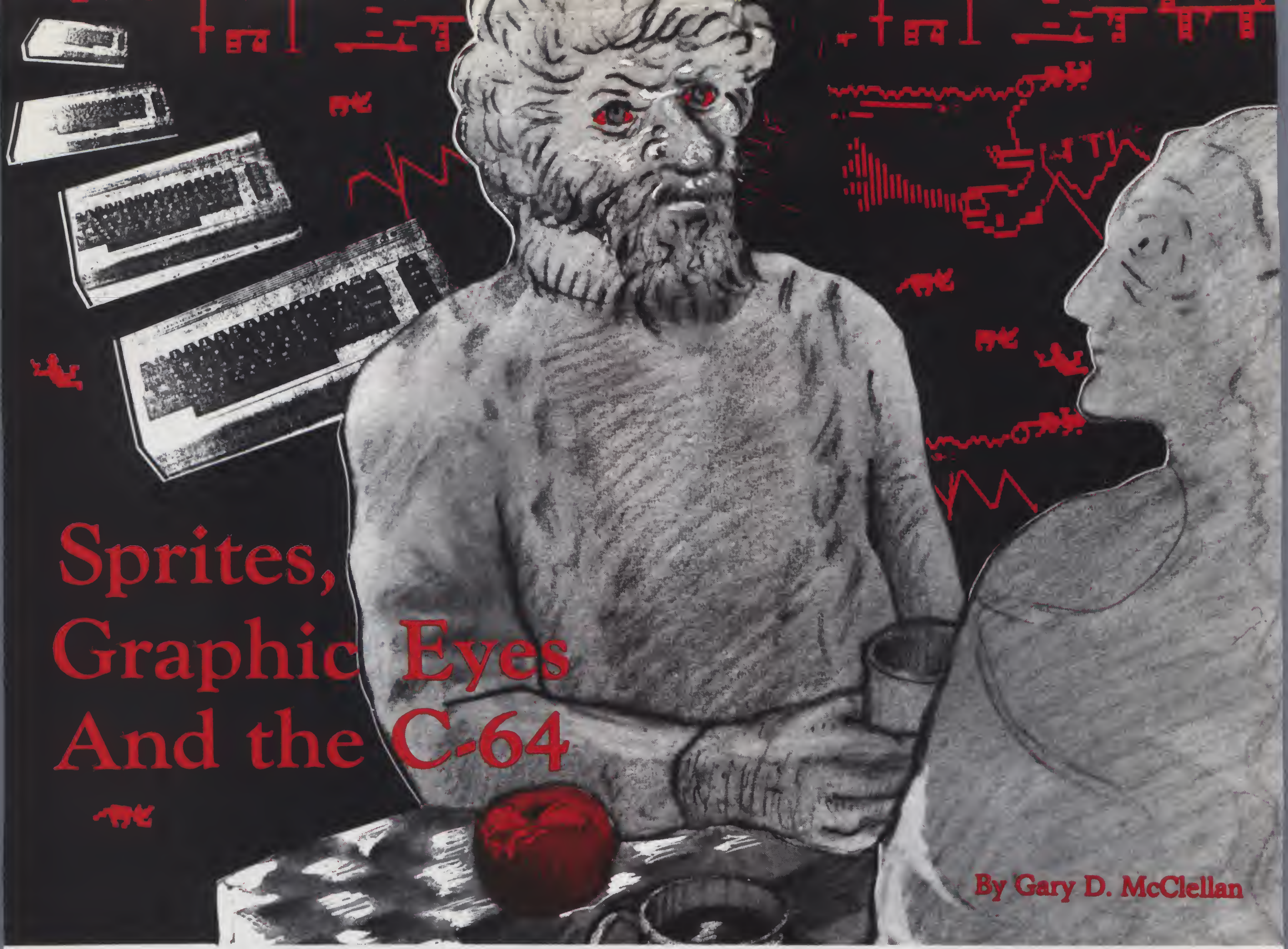

Sprites, Graphic Eyes And the C-64

By Gary D. McClellan

I don't know about you, but when I lie down to sleep at night—blurry-eyed from programming graphics routines—I see peeks, pokes and a parade of graphics characters marching across the back of my eyelids.

I have this sneaking suspicion that "graphics eyes" is a more common affliction than most would admit. I offer this article and the accompanying program as a possible solution.

Visions of Peeks and Pokes

On a recent vacation in northern California, I found myself hunched over a coffee cup in a local restaurant, recovering from the night before.

My companion of long and trusted acquaintance (I'll refer to him as "da Wolf") was in the same condition as I was, recovering from graphics eyes after a long night of programming and gaming on his personal computer. (Da Wolf is one of the few people I know who has a degree in English but thinks in assembly language.)

Da Wolf and I peered at each other through bloodshot eyes and concurred—there had to be a better way.

A Better Way

A few hours later, as we made our way through a parking lot, we noticed a Commodore computer store across the boulevard.

"Shall we?" asked da Wolf.

"Why not?" I answered.

Inside, we discovered the new Commodore-64 personal computer.

I first noticed the C-64's attractive lines. The machine is compact and resembles a VIC-20 with additional ports. Keyboard response and ease of typing approached that of a dedicated terminal. The C-64 looked like a nice machine, but then so do a lot of other systems.

I picked up the user's manual that came with the system and the name suddenly struck home. C-64... Sixty-four K of memory.

The possibility of peeks and pokes nearly overwhelmed me. I flipped through the pages and briefly read the description of the sound synthesizer: three voices, nine octaves, complete software control over attack/decay... The 64 was definitely getting my attention.

I continued scanning the user's manual until I was interrupted by a noise that sounded *like a water* buffalo being strangled. It was da Wolf, who was busily reading over my shoulder.

"Turn the page," he ordered. I turned the page immediately (the last time I saw that particular look on his face was the night the power died when he was halfway finished typing the save command on his system after three hours of intensive coding).

Sprite Graphics

The section of the manual that triggered the outburst from da Wolf was the section that explained Sprite

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Address correspondence to Gary McClellan, Wizard Works Software Engineering, PO Box 1750, Flagstaff, AZ 86002.

Graphics.

A "sprite" is a high-resolution graphics image handled by the 64's video display chip. In high-resolution video, the 64's screen is composed of 320×200 software-controllable points, or pixels. A sprite image is composed of 24×21 of these high-resolution points.

Each point is associated with a bit in a section of memory set aside to define the sprite. Since a byte in memory is eight bits long, a sprite image can be defined as 21 rows of three bytes each, with each byte controlling eight points in the sprite image.

Once a sprite image is defined to the 64's video display chip, the sprite can be moved by updating X and Y registers in the display chip. Up to eight sprites can be handled by the display chip at one time.

I started to shake, thinking how smooth and easy it would be to move hi-res graphics images around the 64's screen.

"Twenty-four by 21," da Wolf kept muttering as he reached over my shoulder to steady the manual.

The shaking worsened. Not only could you control the movement of the sprites by updating video registers, but background/foreground priorities could be set. Sprite #1 could either collide with or pass in front of or behind sprite #2.

Collisions were again indicated by a video register. Sprites could also collide with or pass in front of or behind low-res graphics characters; to top it off, a sprite could be one of 16 colors—or even multicolored.

"Easy, Mac," da Wolf commanded, prying the manual out of my hands. The visions of dancing multicolored sprites slowly ebbed, but I didn't completely relax until we left the computer store, clutching a new C-64.

Later that evening, we explored the 64's capabilities by entering the short demo programs in the user's manual. The colors produced by the 64 on a standard color television set were superb. The music/sound generation was delightful, but best of all, the demo sprite images floated across the screen with smooth, flowing motions.

Since I wanted to try animating some of my own sprite creations, I quickly gathered together the necessary equipment: pencils, graph paper, note paper, binary-to-hex-to-decimal calculator/convertor and *Painter Pete's Learn to Draw Manual for First Grade and Higher*.

As I mentioned earlier, a sprite image is composed of 21 rows of 24 hi-res points. The easiest way to design a sprite image is on graph paper in a 24×21 block grid.

After the image is drawn by filling in blocks on the graph paper, each block represents a bit position in 63 bytes, which is either "on" or "off." Once the 63 bytes are converted to decimal equivalents, typed into a program as data statements and then loaded into the appropriate memory location of the 64 as per the user's manual, our sprite image is ready to be used by a program. Simple, huh?

An hour later, surrounded by crumpled graph paper, smudged notes and broken pencils, I watched a slightly lopsided something (I knew it was a sprite image of a lunar lander, but it took me five minutes to convince da Wolf) move smoothly across the TV screen in vivid color. My sprite image needed a little work.

As I started to attack the graph paper with my eraser, my wife, the graphics designer, walked by and burst into fits of laughter after looking at my attempt at art.

"If the machine's so smart," she said smugly, "why doesn't it do all that for you?"

"Hmmm," I answered with lightning-like repartee.

She was still giggling as she left the room.

I looked at da Wolf. Da Wolf looked at me. The listing of the Sprite Utility Program for the Commodore 64, which accompanies this article (see program listing), was the result of that philosophic, nonverbal discussion.

Utility Overview

The Commodore-64 Sprite Graphics Utility is a menu-driven program composed of various modules that let the user create, edit and animate sprites. Sprites are created by using a "software pen" that draws, erases and lifts for movement to another area of the screen.

Either keyboard or joystick input can control the pen. The sprite is drawn in a 24×21 block grid on the display screen. Each block represents a pixel or graphics point in a sprite image.

A sprite echo mode is supported in the drawing module, which displays a hi-res sprite image in the upper-left corner of the screen when the F1 key is pressed. This echoed image can be expanded on the X or Y axis, or both, while the user composes or modifies a sprite.

A completed sprite is translated to a 63-byte numeric description, which is stored in a data array with a sprite ID number between one and eight. A

Program listing. Sprite graphics utility for the Commodore-64.

```
1 REM ********************************************************************
2 REM OPEN RS-232C I/O CHANNEL (VIC-1011A RS-232 CARTRIDGE)
3 REM ********************************************************************
5 OPEN200,2,3,CHR$(32+6)+CHR$(32+128)
10 GOTO80
12 REM *******************************************************************
13 REM UNPACK BIT VALUES FOR EACH BYTE OF A 63 BYTE ARRAY. IF BIT IS SET THEN
14 REM POKE GRAPHIC CHARACTER IN SCREEN MEMORY TO RECONSTRUCT SPRITE IMAGE
15 REM CALLED BY REDISPLAY ROUTINE.
16 REM *******************************************************************
20 L=1076:J=1:FORI=1TO21
23 FORX=1TO3:A=SD(SN,J)
25 FORY=1TO8:IFAANDDC(Y)THENPOKEL+Y,160:POKEL+Y+OF,0
26 NEXTY
37 L=L+8:J=J+1:NEXTX
40 L=L+16:NEXTI
42 RETURN
45 REM *******************************************************************
46 REM PRINT CHARACTER STRING B$ ON SCREEN STARTING AT SCREEN ADDRESS L2
47 REM *******************************************************************
50 FORX=0TOLEN(B$)-1:CH=ASC(MID$(B$,X+1,1)):IFCH>64THENCH=CH-64
52 POKEL2+X,CH:POKEL2+X+OF,11:NEXTX
54 RETURN
55 REM *******************************************************************
56 REM CREATE 63 BYTE BIT PACKED ARRAY FROM SCREEN IMAGE WHEN CALLED BY SAVE
57 REM *******************************************************************
60 V=53248:POKEV+21,4:POKE2042,13:POKEV+4,45:POKEV+5, 60:POKEV+41,0
62 L=1076:J=1:FORX=1TO21:FORI=1TO3:FORY=1TO8:IFPEEK(L+Y)=160THEND=D+DC(Y)
63 NEXTY:POKE831+J,D:D=0:L=L+8:J=J+1:NEXTI:L=L+16:NEXTX
65 RETURN
75 REM *******************************************************************
76 REM SET UP SCREEN COLORS, DIMENSION ARRAYS, AND INITIALIZE FLAGS
77 REM *******************************************************************
80 POKE53281,15:POKE53281,1:POKE646,12:SN=0:RE=0:V=53248
85 PRINTCHR$(147):POKE53248+21,0:OF=54272
86 DIMSD(8,63),TD(63),DC(8),SS(8),TN(8),DR(3),G(3)
87 REM *******************************************************************
88 REM LOAD BIT VALUE ARRAY
89 REM *******************************************************************
91 C=256:FORX=1TO8:DC(X)=C/2:C=DC(X):NEXT
98 REM *******************************************************************
```

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ZENITH data systems
THE QUALITY GOES IN BEFORE THE NAME GOES ON

completed sprite can be redisplayed, changed slightly and stored under another ID number to create variations on a theme.

Any sprite stored in the sprite data array can be animated with the keyboard or joystick in port 2. The program prompts the user for ID number, color, size and keyboard or joystick control.

The 63-byte description of a completed sprite can be displayed on the screen or dumped to a printer. This description can be used in data statements in application/game programs that use sprite graphics.

The sprite data array of completed sprite data (up to eight sprites) can be written to tape over a user-defined file name. The data can then be loaded from tape for further editing, or loaded directly by application/game programs. A data array was chosen for storage since a game program can load different sprites for testing under playing conditions without the programmer having to type in different data statements to try different sprites.

Once the programmer is happy with the sprite shapes, the sprites can be converted to data statements for permanent inclusion in the program, or they can follow the program on tape for loading by the program.

Since up to eight separate sprites can exist in a data array, a function is supported that indicates sprites stored in the array by ID numbers.

Program Description

Line 5—Opens the C-64 RS-232 I/O channel as a 300-baud, three-wire device (hard copy terminal). The device file number is opened as file number 200. When using the VIC 1011A RS-232 cartridge, a file number greater than 127 forces a line feed to automatically follow a carriage return sent to the device (printer).

The number 2 following the file number is the device address, and, in this case, the default value of the

Listing continued.

```
99 REM PRINT MENU OF COMMANDS
100 REM*********************************************************************
101 PRINT"****************************************"
102 PRINT"*                                      *"
103 PRINT"*                                      *"
104 PRINT"*   COMMODORE 64 SPRITE GRAPHICS       *"
105 PRINT"*   UTILITY                            *"
106 PRINT"*   WIZARDWORKS SOFTWARE ENGINEERING   *"
107 PRINT"*                                      *"
108 PRINT"*   WRITTEN BY GARY D MCCLELLAN        *"
109 PRINT"*   P.O. BOX 1750                      *"
110 PRINT"*   FLAGSTAFF.AZ  86002                *"
112 PRINT"*                                      *"
113 PRINT"****************************************"
115 FORX=1TO5000:NEXT
200 PRINTCHR$(147): PRINT"   ***   SPRITE UTILITY MENU   ***"
205 PRINT:PRINT:PRINT
210 PRINT"   'C' CREATES SPRITES"
211 PRINT"   'A' WILL ANIMATE ANY OF YOUR SPRITE        CREATIONS"
212 PRINT"   'L' LOADS SPRITE DATA FROM TAPE INTO       SPRITE DATA ARRAY"
213 PRINT"   'E' EXITS ANY FUNCTION AND RETURNS TO      MENU"
214 PRINT"   'S' SAVES SPRITE DATA ARRAY ON TAPE"
215 PRINT"   'D' DISPLAYS 63 BYTE DATA DESCRIPTION      OF A SPRITE"
217 PRINT"   'N' DISPLAYS NUMBER OF SPRITES             CREATED"
218 PRINT"   'R' WILL REDISPLAY A CREATED SPRITE        FOR GRAPHIC EDITING"
219 PRINT"   'Q' (QUIT) WILL END PROGRAM"
220 REM ********************************************************************
221 REM READ KEYBOARD AND BRANCH TO REQUESTED MODULE
222 REM ********************************************************************
223 PRINT:PRINT:PRINT"ENTER REQUEST";
224 INPUTA$
225 PRINTCHR$(147)
230 IFA$="C"GOTO400
240 IFA$="A"GOTO900
250 IFA$="L"GOTO800
260 IFA$="E"GOTO200
270 IFA$="S"GOTO1000
275 IFA$="D"GOTO600
276 IFA$="N"GOTO300
277 IFA$="R"THENRE=1:GOTO400
279 IFA$="Q"THENCLOSE200:END
280 GOTO200
290 REM ********************************************************************
291 REM DISPLAY SPRITE IMAGES CREATED (STATUS OF SPRITE DATA ARRAY)
292 REM ********************************************************************
300 FORX=1TO8:
310 IFSS(X)=1THENPRINT"SPRITE NUMBER";X;"IN SPRITE DATA ARRAY.":GOTO340
320 PRINT"SPRITE NUMBER";X;"NOT CREATED."
340 NEXTX
350 INPUT"ENTER ANY CHARACTER TO EXIT";A$:GOTO200
380 REM ********************************************************************
381 REM PRINT OPERATOR COMMANDS AND INSTRUCTIONS FOR SPRITE DRAW ROUTINE
382 REM ********************************************************************
400 PRINT"CREATE SPRITE IMAGES BY MOVING YOUR PEN WITH THE CURSOR KEYS. F3 = ";
401 PRINT"PEN UP (";CHR$(123);").  F5 = ERASE (";CHR$(119);"). F7 = DRAW (";
402 PRINT CHR$(113);"). A JOYSTICK IN PORT 2 WILL ALSO MOVE THE PEN. PRESS THE";
403 PRINT" FIRE BUTTON TO SELECT PEN UP, ERASE, OR DRAW.":PRINT
404 PRINT"     PRESS 'Q' TO EXIT THE ROUTINE WHEN YOUR SPRITE IS COMPLETE."
405 PRINT: IFRE=0GOTO411
406 INPUT"ENTER SPRITE# TO REDISPLAY-";SN
```

More

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Listing continued.

```
407 IFSN<1ORSN>8THENPRINT"1 THRU 8 PLEASE.":GOTO406
408 IFSS(SN)=0THENPRINT"SORRY- SPRITE NUMBER";SN;"NOT CREATED.":RE=0:GOTO400
409 PRINT:PRINT"     TO REDISPLAY SPRITE NUMBER";SN;"PLEASE";
411 PRINT:PRINT:PRINT"PRESS 'S' TO START-"
412 INPUTA$:IFA$="E"GOTO200
413 IFA$<>"S"GOTO411
414 B=1036:L=1077:BL=0:L1=1077:G=32:BG=90:G(1)=160:G(2)=32 :G(3)=32:G1=3:GT=32
415 DR(1)=81:DR(2)=87:DR(3)=91
416 PRINTCHR$(147):B$="F1= SPRITE":L2=1385:GOSUB50:B$="ECHO MODE":L2=1425
417 GOSUB50:B$="R= NORMAL":L2=1505:GOSUB50:B$="SPRITE":L2=1545:GOSUB50
418 B$="X= X AXIS":L2=1625:GOSUB50:B$="EXPANDED":L2=1665:GOSUB50:B$="Y= Y AXIS"
419 L2=1745:GOSUB50:B$="EXPANDED":L2=1785:GOSUB50:B$="G= X AND Y":L2=1865:
420 GOSUB50:B$="EXPANDED":L2=1905:GOSUB50
421 FORX=BTOB+25:POKEX,BG:POKEX+OF,15:POKEX+22*40,BG:POKEX+(22*40)+OF,15:NEXT
422 POKE1048+OF,11:POKE1049+OF,11:POKE1049+22*40+OF,11:POKE1048+22*40+OF,11
423 FORX=BTOB+22*40STEP40:POKEX,BG:POKEX+OF,15:POKEX+25,BG:POKEX+25+OF,15:NEXT
425 L2=1985:B$="    PRESS 'Q' WHEN SPRITE COMPLETE  ":GOSUB50
428 FORX=BTOB+22*40STEP40:POKEX,BG:POKEX+OF,15:POKEX+25,BG:POKEX+25+OF,15:NEXT
429 POKE1476+OF,11:POKE1476+25+OF,11
430 REM **********************************************************************
431 REM CHECK FOR REDISPLAY SPRITE REQUEST. GOSUB IF FLAG SET
432 REM **********************************************************************
433 IFRE>0THENGOSUB20:RE=0
435 REM **********************************************************************
436 REM EXECUTE MOVE, DRAW, OR ERASE AND SPRITE ECHO MODE FUNCTIONS WHEN
437 REM WHEN REQUESTED BY KEYBOARD OR JOYSTICK
438 REM **********************************************************************
444 L=1077
445 IFG1=3THENG(G1)=GT
446 POKEL,G(G1):POKEL+OF,0:BL=BL+1
447 IFBL=1THENPOKEL,DR(G1)
448 IFBL=2THENBL=0
450 REM **********************************************************************
451 REM READ KEYBOARD
452 REM **********************************************************************
453 GETA$:IFA$=""THENX=0:GOTO455
454 X=ASC(A$)
455 IFX=29THENL=L+1
456 IFX=157THENL=L-1
457 IFX=17THENL=L+40
458 IFX=145THENL=L-40
459 IFX=135THENG1=1
460 IFX=136THENG1=2
461 IFX=81THENGOTO500
462 IFX=134THENG1=3
463 IFX=133THENGOSUB60
464 IFX=82THENPOKE53271,0:POKE53277,0
465 IFX=88THENPOKE53271,0:POKE53277,4
```

More →

RS-232 interface. When this device is opened, an I/O buffer is set up in upper user memory. Unless this statement is executed first in the program, string variables stored in upper memory may disappear unexpectedly.

If an Epson MX-80 printer is used with the RS-232 interface, the open statement should be changed to:

OPEN200,2,1,CHR$(10+32)+CHR$(128+1)

This sets up the interface for full handshaking at 2400 baud with no parity.

Lines 20-42—This subroutine translates a 63-byte sprite description into 504-bit values and places a solid block on the screen if a bit is set.

Lines 50-54—This subroutine will print a character string anywhere on the display screen. The starting location on the screen is passed to the subroutine as variable L2, and the character string is passed as string variable B$.

Lines 60-65—When this subroutine is executed, it translates the screen image of a completed sprite into a 63-byte, bit-packed array.

Lines 80-91—Initialization routines set up screen colors, clear the screen and define the start of color memory (variable OF) for color control.

HERO 1 Robot Programming Contest

Attention, HERO 1 owners! It's time for you to come to the fore. We know that you have been experimenting with your Heath robot. Now you have an opportunity to show us—and your fellow robot enthusiasts—what you have done.

What uses have you devised for your HERO 1 robot? *Microcomputing* wants to know, so, in conjunction with the Heath Company, manufacturers of the HERO 1, we are sponsoring a contest just for you.

Now's your chance to show off your robotics programming skill in the first ever *Microcomputing*/Heath HERO 1 Programming Contest. You'll have an opportunity to demonstrate your robotics knowledge and creativity in the following contest categories:

1. Standard HERO 1 with arm.
2. Modified HERO 1, including additional RAM or ROM, as well as any mechanical or electrical modifications.

The first place entry in each category will win a $500 gift certificate to be used toward the purchase of any product from the latest Heath catalog. We'll be awarding prizes to the top three entrants in each category.

Here are the details:

1. All programs must be submitted both on cassette tape and in hard copy form. A brief, written description of the application must accompany each entry.
2. Entries in the modified category must include a complete description of the alterations performed on the robot.
3. The contest is open to all HERO 1 owners, except employees of Wayne Green, Inc., and Heath Company and their immediate families.
4. All entries, including programs, become the property of *Microcomputing*.
5. All entries should include the name, address and telephone number of the author, and the category being entered.
6. All entries must be received by *Microcomputing* by September 1, 1983. Send submissions to:

Microcomputing
HERO 1 Programming Contest
80 Pine Street
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Entries will be judged on originality and technical feasibility. While many entries will be designed to accomplish a specific application in a specific setting, the more universal and useful the program is, the better. All judges will be selected by *Microcomputing*.

Prizes:

First prize in each category will be a Heath $500 gift certificate. The winners will be able to select the prize of their choice, not to exceed $500, from the latest Heath Company catalog. Prizes for second- and third-place winners will be announced.

Winners will be announced in the December 1983 issue of *Microcomputing*.

For you non-HERO 1 owners, it's still not too late to purchase a unit, develop an application and submit it to the contest (you have over three months). And don't be intimidated if you've never worked with robots before. In a contest such as this, your creativity and imagination are the most important factors in determining the prize-winning applications. Let's put Heath's HERO through its paces.

Line 91 creates an eight-element array of bit values in a byte.

Lines 100–219—This routine displays title message and menu options.

Lines 221–280—This routine samples the keyboard and branches to the requested module. If an invalid key is read, the program redisplays the menu.

Lines 300–350—When executed, this routine displays the status of the sprite data array by sprite ID number.

Lines 400–530—The sprite draw routine is entered at line 400 to create a new sprite or to redisplay a sprite. The redisplay flag (variable RE) is set to 1 if the redisplay function is requested. Lines 400–429 print the operator commands, prompt for sprite ID number in redisplay mode, clear the screen, set up the border of the 24×21 drawing grid and display sprite echo mode commands on the screen.

Line 433 calls the bit-unpacking subroutine to redisplay a sprite when requested. Lines 436–496 sample the keyboard or a joystick in port 2 to move the pen. The pen is lifted, set in erase mode or set in draw mode by either the function keys or the fire button on the joystick.

When the program detects the Q

Listing continued.

```
466 IFX=89THENPOKE53271,4:POKE53277,0
467 IFX=71THENPOKE53271,4:POKE53277,4
468 REM ************************************************************
469 REM READ JOYSTICK PORT 2
470 REM ************************************************************
471 JO=PEEK(56320):IFJO=126THENL=L-40
472 IFJO=118THENL=L-39
473 IFJO=119THENL=L+1
474 IFJO=117THENL=L+41
475 IFJO=125THENL=L+40
476 IFJO=121THENL=L+39
478 IFJO=123THENL=L-1
479 IFJO=122THENL=L-41
481 IFJO=111THENG1=G1+1:IFG1=4THENG1=1
482 IFG1=2THENGT=32
490 IFPEEK(L)=BGTHENL=L1
491 IFL1=LTHEN495
492 IFG1=3THENGT=PEEK(L)
495 POKEL1,G(G1):POKEL1+OF,0:L1=L:GOTO445
497 REM ************************************************************
498 REM SAVE SCREEN IMAGE IN BIT-PACKED TEMPORARY ARRAY
499 REM ************************************************************
500 L2=1987:B$="HOLD ON- SPRITE IMAGE BEING COPIED   ":GOSUB50:DC=1
501 POKE53248+21,0
504 L=1076:J=1:FORX=1TO21:FORI=1TO3:FORY=1TO8:IFPEEK(L+Y)=160THEND=D+DC(Y)
530 NEXTY:TD(J)=D:D=0:L=L+8:J=J+1:NEXTI:L=L+16:NEXTX
550 REM ************************************************************
551 REM STORE TEMPORARY SPRITE ARRAY IN SPRITE DATA ARRAY OR EXIT
552 REM ************************************************************
554 PRINTCHR$(147)
555 PRINT"ENTER 'S' TO STORE YOUR SPRITE IN SPRITE DATA ARRAY."
557 PRINT"ENTER 'E' TO EXIT FUNCTION."
558 INPUTA$:IFA$="S"THEN700
559 IFA$="E"ANDDC=0THEN200
560 REM ************************************************************
561 REM VERIFY EARLY EXIT REQUEST
562 REM ************************************************************
570 PRINT:PRINT"SPRITE DATA NOT SAVED. PLEASE VERIFY EXIT."
571 PRINT"ENTER 'Y'ES OR 'N'O.":INPUTA$:IFA$="N"THEN555
575 IFA$="Y"THEN200
580 GOTO570
600 REM ************************************************************
601 REM PRINT INSTRUCTIONS FOR ROUTINE TO DISPLAY DECIMEL VALUES OF 63 BYTE
602 REM ************************************************************
605 PRINTCHR$(147)
608 PRINT"THIS ROUTINE DISPLAYS THE 63 BYTE DATA  DESCRIPTION OF A SPRITE."
610 PRINT:PRINT"ENTER THE NUMBER OF THE SPRITE YOU WANT TO DISPLAY DATA FOR.";
```

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key, lines 500–530 are executed, and the sprite image is bit-packed into a 63-byte temporary array.

Lines 554–580—This routine stores the temporary sprite array in the permanent sprite data array. The user is prompted for the ID number. If a mistake is made in keying and the exit key is pressed prior to storage, the program will prompt the user for exit verification.

This routine is necessary since the C-64 has a type-ahead character input buffer, which allows several keys to be typed in sequence and then executed by the program. The exit verification routine will save the sprite data from being destroyed by accident.

Lines 605–650—This routine displays a 63-byte description of a completed sprite on the screen or as printed output. If a VIC printer is being used as device 4, the only change necessary is to replace the device number 2 with 4 in the open statement in line 5 (theoretically, at least;

Listing continued.

```
611 PRINT"ENTER A 'O' TO EXIT THE ROUTINE."
612 INPUTSN:IFSN=0GOTO200
614 IFSN<1ORSN>8THENPRINT"1 THRU 8 PLEASE":GOTO610
615 REM ******************************************************************
616 REM CHECK FOR PRINTED OUTPUT OR SCREEN DISPLAY AND SEND TO REQUESTED DEVICE
617 REM ******************************************************************
620 PRINT"ENTER A 'P' FOR PRINTER OUTPUT OR AN 'S' FOR SCREEN OUTPUT"
625 INPUTA$:IFA$="P"THENPR=1
628 IFPR=1THENPRINT#200,CHR$(13)
629 IFPR=1THENPRINT#200,"    SPRITE";SN;"DATA DESCRIPTION":PRINT#200,CHR$(13)
630 IFPR=1GOTO640
631 PRINT"    SPRITE";SN;"DATA DESCRIPTION":PRINT
634 TC=1:FORX=1TO21:PRINT"BYTE";TC,:FORJ=1TO3:PRINTSD(SN,TC),:TC=TC+1:NEXTJ,X
635 GOTO647
640 TC=1:FORX=1TO7:PRINT#200,"BYTE";TC,:FORJ=1TO9:PRINT#200,SD(SN,TC);:TC=TC+1
642 NEXTJ:PRINT#200,CHR$(13):NEXTX
647 PRINT"ENTER ANY CHARACTER FOR MENU.":PR=0
650 INPUTA$:GOTO200
690 REM ******************************************************************
695 REM COPY DATA FROM TEMPORARY SCREEN SAVE ARRAY TO SPRITE DATA ARRAY
700 REM ******************************************************************
701 PRINT"ENTER SPRITE NUMBER YOU WISH TO SAVE SCREEN DISPLAY TO, OR ENTER A";
702 PRINT" 'O' TO EXIT.":DC=0
```

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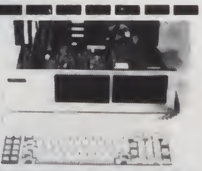

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☐ See Review in *Microcomputing*, January 1983, page 158.

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Listing continued.

```
704 INPUTSN:IFSN=0THEN200
705 IFSN<1ORSN>8THENPRINT"ENTER 1 THROUGH 8, PLEASE-":GOTO701
710 FORI=1TO63:SD(SN,I)=TD(I):NEXT:SS(SN)=1
720 PRINT"SPRITE NUMBER";SN;"DISPLAY DATA HAS BEEN SAVED IN SPRITE DATI ARRAY"
730 INPUT"ENTER ANY CHARACTER TO EXIT";A$:GOTO550
740 PRINT ERROR TRAP:END
800 REM ************************************************************************
801 REM LOAD SPRITE DATA ARRAY FROM TAPE FILE
802 REM ************************************************************************
805 PRINT"THIS ROUTINE LOADS THE SPRITE DATA ARRAY FROM TAPE FILE #1."
810 PRINT"ENTER 'L' TO LOAD THE ARRAY OR AN 'E' TO EXIT-"
820 INPUTA$:IFA$="E"THEN200
830 IFA$<>"L"THENPRINT"'E' OR 'L' PLEASE-":GOTO820
833 PRINT"ENTER THE FILE NAME TO LOAD FROM. ('SPRITE DATA' IS THE DEFAULT FILE";
835 PRINT" NAME SEARCHED FOR."
840 SA$="SPRITE DATA":INPUTSA$
845 IFSA$="E"THEN200
850 OPEN 1,1,0,SA$
860 FORI=1TO8
870 INPUT#1,SS(I)
880 FORJ=1TO63:INPUT#1,SD(I,J)
881 NEXTJ
890 NEXTI
891 CLOSE1
892 PRINT"THE SPRITE DATA ARRAY HAS BEEN LOADED FROM TAPE. ENTER ANY CHARACTER"
894 PRINT"TO EXIT."
895 INPUTA$:GOTO200
900 REM ************************************************************************
901 REM ANIMATE REQUESTED SPRITE IMAGE FROM SPRITE DATA ARRAY BY KEYBOARD OR
902 REM JOYSTICK INPUT
903 REM ************************************************************************
910 PRINTCHR$(147)
920 PRINT"THIS ROUTINE WILL ANIMATE ONE OF YOUR SPRITE CREATIONS "
930 PRINT"YOUR SPRITE CAN BE MOVED AROUND THE SCREEN WITH THE ";
932 PRINT"CURSOR KEYS ON THE KEYBOARD OR A JOYSTICK IN PORT 2."
935 PRINT"ENTER 'K' FOR KEYBOARD ANIMATION OR 'J' FOR JOYSTICK ANIMATION."
936 PRINT"(PRESS 'E' TO EXIT ROUTINE)"
937 INPUTA$:
938 K=0:IFA$="J"THENK=1
939 IFA$="K"THENK=2
941 IFA$="E"THEN200
943 IFK=0THEN920
944 REM ************************************************************************
945 REM GET SPRITE NUMBER, COLOR AND DISPLAY MODE AND SET UP SPRITE REGISTERS
946 REM ************************************************************************
952 INPUT"ENTER SPRITE NUMBER TO ANIMATE";SN
```

More →

since I don't have a VIC printer, I've never tried this).

Lines 700–740—The sprite data save routine at lines 552–580 branches to this routine to save the temporary sprite array to the permanent array. The routine returns to the calling routine so that a single sprite could be saved over several ID numbers for later modification.

Lines 802–895—The tape load routine loads the sprite data array from tape for editing previously saved sprites. The routine prompts for the file name to be read from tape. Otherwise, it defaults to a file name of "sprite data," the same default name that the tape save routine uses.

This code should be added to your application/game programs to allow you to use numerous sprite images stored in different arrays on tape.

Lines 952–999—This routine animates a created sprite in the following manner: Lines 910–943 print starting instructions and prompts for keyboard/joystick use. Lines 952–966 prompt for sprite ID, sprite color (0–15 as defined in the C-64 user's manual) and display mode (expanded

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X, expanded Y, both or normal). The variable V is the starting address of the video display chip, and appropriate values are poked into offsets from V to set up the sprite.

Lines 968–970 load user memory, starting at location 837 decimal with the 63-byte data description of the sprite; these lines also load location 2042 decimal with a pointer to the sprite data.

Lines 975–987 animate the sprite as a keyboard control routine when the cursor keys are pressed. The routine moves the sprite in the direction indicated by the cursor arrow on the key. If the E key is pressed, the routine is exited and the program returns to the menu.

Lines 988–999 animate the sprite as a joystick control routine. The sprite is moved in the direction that the joystick is pushed. In this routine, joystick port 2 is sampled and ANDed with NOT values (bits set to 0) to determine the direction the joystick is pushed. This differs from the routine at lines 471–495, which reads actual values from the joystick and tests for these values with IF statements.

Lines 1010–1140—The tape save routine writes the sprite data array to a tape file and saves the array over a user-defined file name. Otherwise, the file name defaults to "sprite data."

Conclusions

I hope this program will prompt Commodore-64 owners to design interesting games using the capabilities of sprite graphics. I firmly believe the C-64 is the ultimate game computer available; I'd like nothing better than to see the pages of *Microcomputing* flooded with graphics games for the C-64.

(For anyone who doesn't like the idea of typing in the program by hand, send a check or money order for $5 and a blank tape, or $8 without tape, to Wizard Works Software Engineering, PO Box 1750, Flagstaff, AZ 86002, and I will send you a copy of the program.) ■

Listing continued.

```
 953 IFSS(SN)=0THENPRINT"SORRY- SPRITE NUMBER";SN;"NOT CREATED.":GOTO910
 955 PRINT"ENTER '0' TO '15' FOR THE COLOR OF YOUR SPRITE"
 956 INPUTA:IFA<0 OR A>15THENPRINT"MUST BE FROM 0 TO 15.":GOTO955
 957 CL=A
 958 PRINT"ENTER 'R' FOR STANDARD SPRITE"
 959 PRINT"       'X' FOR EXPANDED X SPRITE"
 960 PRINT"       'Y' FOR EXPANDED Y SPRITE"
 961 PRINT"       'G' FOR EXPANDED X,Y SPRITE"
 962 INPUTA$:IF A$=CHR$(13)ORA$="R"THEN967
 963 IFA$="X"THENPOKEV+29,4
 964 IFA$="Y"THENPOKEV+23,4
 965 IFA$="G"THENPOKEV+29,4:POKEV+23,4
 966 IFA$="E"GOTO200
 967 PRINTCHR$(147)
 968 V=53248:POKEV+21,4:POKE2042,13:VS=831:X1=100:Y1=100:POKEV+41,0:
 969 FORX=1TO63:POKEVS+X,SD(SN,X):NEXT
 970 POKEV+4,X1:POKEV+5,Y1:POKEV+41,CL
 971 REM ******************************************************************
 972 REM READ KEYBOARD OR JOYSTICK PORT 2 FOR SPRITE VECTORS
 973 REM ******************************************************************
 975 GETA$:IFA$=""THENX=0:GOTO982
 980 X=ASC(A$)
 981 IFK=1THEN986
 982 IFX=17THENY1=Y1+1:IFY1=200THENY1=0
 983 IFX=29THENX1=X1+1:IFX1=256THENX1=0
 984 IFX=145THENY1=Y1-1:IFY1=0THENY1=199
 985 IFX=157THENX1=X1-1:IFX1=0THENX1=255
 986 IFX=69THENPOKEV+21,0:POKEV+23,0:POKEV+29,0:GOTO200
 987 IFK=0THEN998
 988 JO=PEEK(56320):IFNOTJOAND1THENY1=Y1-1:IFY1=0THENY1=200
 989 IFNOTJOAND8THENX1=X1+1:IFX1=256THENX1=0
 990 IFNOTJOAND2THENY1=Y1+1:IFY1=200THENY1=0
 991 IFNOTJOAND4THENX1=X1-1:IFX1=0THENX1=255
 998 POKEV+4,X1:POKEV+5,Y1
 999 GOTO975
1000 REM ******************************************************************
1001 REM SAVE SPRITE DATA ARRAY TO TAPE FILE BY REQUESTED FILE NAME
1002 REM ******************************************************************
1010 PRINT"THIS ROUTINE SAVES THE SPRITE DATA ARRAY ONTO TAPE, FILE #1."
1020 PRINT"ENTER 'S' TO START THE FUNCTION OR 'E' TO EXIT."
1030 INPUTA$:IF A$="E"THEN200
1040 IFA$<>"S"THENPRINT"'E' OR 'S' PLEASE-";:GOTO1010
1042 PRINT"PLEASE ENTER THE FILE NAME YOU WOULD LIKE THE ARRAY SAVED OVER.";
1043 PRINT"( 'SPRITE DATA' IS THE DEFAULT FILE NAME.)"
1044 SA$="SPRITE DATA":INPUTSA$
1045 IFSA$="E"THEN200
1055 OPEN 1,1,1,SA$
1060 FORI=1TO8
1070 PRINT#1,SS(I)
1080 FORJ=1TO63:PRINT#1,SD(I,J)
1090 NEXTJ
1100 NEXTI
1109 CLOSE1
1110 PRINT"YOUR SPRITE DATA ARRAY HAS BEEN SAVED ONTO A TAPE FILE. THE FILE"
1120 PRINT"NUMBER IS 1 AND THE FILE NAME IS '";SA$;"'"
1130 PRINT "ENTER ANY CHARACTER TO EXIT"
1140 INPUTA$:GOTO200
1150 END
READY.
```

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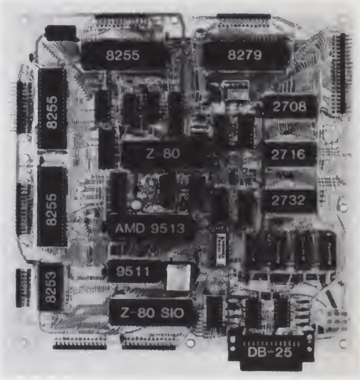

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El Cheapo Serial Interface

Free up the parallel port on your computer with this simple do-it-yourself serial interface project for the MX-80 printer.

By Thomas Franks

Do you have an Epson MX-80 tying up one of your computer's precious parallel ports? Or have you considered buying an Epson, but didn't want to pay extra for the serial interface?

The interface I'll describe here will solve those problems—and let your Epson MX-80 print serial data. All you need, in addition to the interface, is your computer (which should have a serial port with handshaking or an available one-bit input port) and an Epson MX-80 printer.

Like many computer owners, the first addition to my system was a printer. I was initially attracted to the MX-80; Epson printers enjoy the reputation of being reliable, versatile and cost-efficient. About that time, some manufacturers introduced low-cost printers with built-in serial interfaces. With prices dropping, Epson's serial board at $60 was nearly 13 percent of the cost of an MX-80.

Fortunately, a friend of mine had just purchased an MX-80 with a serial option board. He asked me to help

Header Pin	Used By Epson For:
1	*
2	*
3	B4—one of the lines for the baud rate switches.
4	RDY—this line is 0 V when printer is ready for a character.
5	B3 one of the lines for the baud rate switches.
6	*
7	Pdis—this line is used to enable or disable parity checks of incoming data.
8	*
9	O/E controls whether parity check is for Odd or Even parity.
10	*
11	SER IN—input for TTL level serial data.
12	AC2—a low-voltage AC source.
13	*
14	AC1—low-voltage AC used with AC2 and a half-wave rectifier to generate -12 VDC on Epson card.
15	B2—one of the lines used to select the baud rate.
16	+5 VDC—logic power supply.
17	B1—one of the lines used to select the baud rate.
18	*
19	8/7—line to control the number of bits per received byte.
20	+12 VDC signal translator power supply.
21	Ground—power supply common.
22	*
23	SEL IN—pulling this line to +5 VDC disables printer.
24	Connect to pin 21.
25	*
26	Connect to pin 21.

* Denotes no connection made to this pin on the Epson board.

Table 1. Epson header pin function assignments.

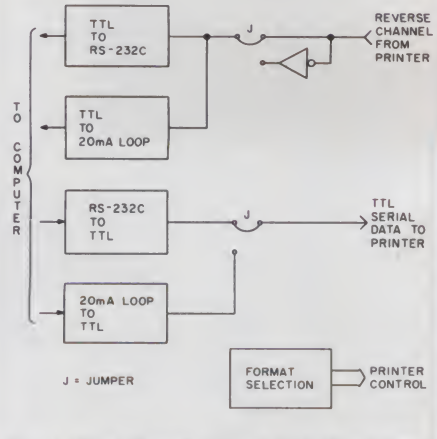

Fig. 1. Block diagram of the 8141 Epson serial interface board.

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®VIC-20 is a registered trademark of Commodore him interface the unit to his OSI C1P; he was having trouble with the handshaking signals. Seeing his printer run and getting a close look at the Epson serial interface board revealed a startling fact: The MX-80 comes with the serial interface built in! All the serial option board does is provide level-shifting circuitry and serial format control.

How Epson Does It

Fig. 1 shows in block form the essential parts of the Epson interface board. Input from the computer is through a DB-25 connector and output to the printer is through a header made of 26 pins .025 inches square in two rows on .1-inch centers. Epson uses opto-isolators for the current loop inputs. A 75188 and a 75189 integrated circuit pair provides RS232-C conversion. Format selection is done with jumpers (8140 board) or with an eight-position DIP switch (8141 board).

Fig. 2 shows the circuit I used in the interface. The transistor changes the positive and negative voltages of RS232-C to TTL levels and is a copy of the circuit used by Synertek Systems Corp. on my SYM-1. The printer has plenty of drive for the reverse channel (also known as the Ready, or Clear-To-Send, signal); I connected this directly to an unused bit of a parallel port on my SYM-1.

How To Build It

I used a Radio Shack experimenter's board to build my interface; an option is to etch a circuit board. There is nothing critical about the circuit layout. I used a 4×4½-inch epoxy-glass board with a .1×.1 matrix of .042-inch holes, with one solder pad per hole.

Fig. 3 shows the mounting holes you'll need to drill and their relationship to the 26-pin header that plugs into the printer. (Be careful; this relationship must be maintained for proper alignment of the board in the printer.)

I fabricated the header by soldering in Vector T-44 push-in wire-wrap pins. You could cut up a few old wire-wrap sockets or buy a real header if you feel extravagant. Optionally, you can cut the board, as I did, in the "L" shape shown in the dotted lines. This exposes the sockets in the printer for additional ROMs without having to remove the interface board.

Fasten your input connector to the edge connector portion of the experimenter board. Let it extend over the edge a little to make it easy to get to once you install the board in the printer. Go traditional with a DB-25 or customize. Solder your cable directly on to the board if you like. I used mating four-pin Molex connectors from Radio Shack.

If you're running a current loop, just put your own signal translator in place of the one I used. There have been many circuits and articles published that deal with this subject. You can even add an inverter to change the sense of the reverse channel signal.

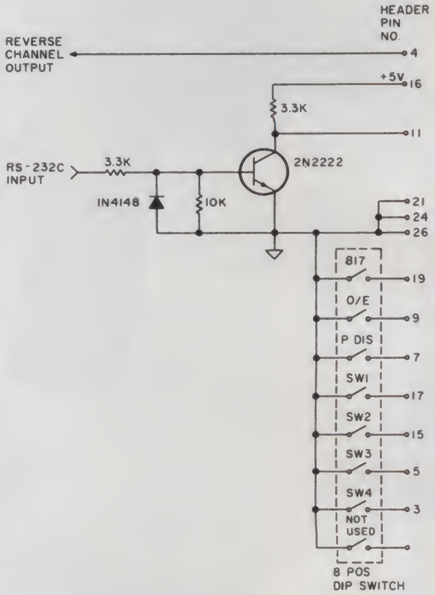

Fig. 2. Circuit used in the $10 interface board.

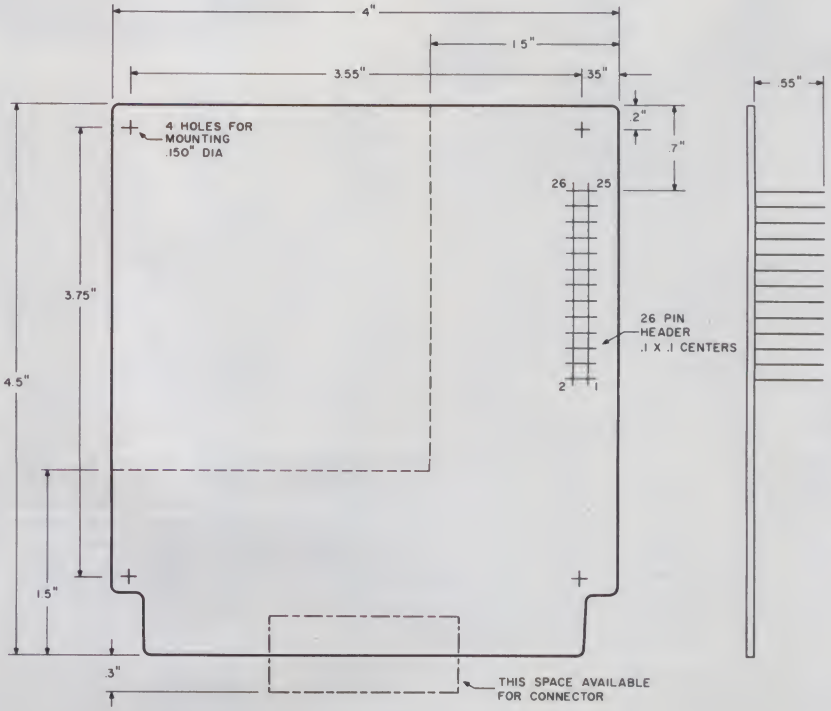
4"
1.5"
3.55"
.35"
.55"
.2"
.7"
4 HOLES FOR MOUNTING .150" DIA
26
25
3.75"
26 PIN HEADER .1 X .1 CENTERS
2
1
4.5"
1.5"
.3"
THIS SPACE AVAILABLE FOR CONNECTOR

Fig. 3. Dimensions for construction of the $10 interface. Be careful of the relationship between the header and the mounting holes.

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Table 2 shows you how to set the DIP switches to match your computer. Once that's done, you're ready to install the interface.

Installation And Checkout

With the printer's power cord unplugged, follow the directions in your Epson manual (pp. 12 and 13) for removing the top cover. In the center-rear part of the printer, close to the DIP switches, are four plastic posts. Tap the holes in those posts for 6-32 machine screws, being careful to remove any displaced plastic from the printer (alternately, you could use self-tapping screws). Line up the header pins with the socket in the printer. Push the pins home firmly, but gently. Fasten the board with the 6-32 hardware.

Replace the top cover on the printer, again following the instructions in your user's manual.

Connect the printer to your computer's serial port and turn on the printer and the computer. Output directed to the port should appear on the printer.

I connected the reverse channel signal to bit 5 of a port at $A000 on my SYM-1. The patch in my output driver to operate the printer is:

```
PHA          ;save the character
LDA $A000    ;load port B
AND #$20     ;mask bit 5
BNE * -7     ;if bit 5 not 0 check
              again
PLA          ;retrieve the character
              to print
JSR TOUT     ;serial output routine in
              SYM-1 monitor
RTS          ;return to calling
              program
```

Trouble?

It's important that you sense the reverse channel signal, either through your serial port hardware or through a one-bit input port. This is the line that synchronizes your computer and printer together. Without it, or sensed improperly, your computer can overflow the printer with characters. This is especially true during MX-80 mechanical operations, such as carriage return, line feed and form feed. Loss of characters or no characters printed can be the result.

As it originates from the printer, this signal is 0 V when it's clear to send one character. If your computer requires a +5 V or a current loop format, you must add an inverter or level shift circuitry to the interface board. A possible alternative would be to patch the driving software, but this would be more difficult in most cases.

Other difficulties can be traced to two things. Double-check your setting of the DIP switch on the interface board. Incorrect parity, word length or baud rate settings will make your computer and printer blissfully ignore each other.

Also, check your level shift circuitry. In building the circuit shown, I transposed the 10K stabilization resistor with the 3.3K collector resistor. The result was insufficient pull-up current to drive the printer, even though the reverse channel was being sensed properly!

Congratulations!

You now have one of the finest printers in its price range running with a serial interface. This interface has saved you $50 and freed a parallel port (important to us control-the-world types). You have also gained experience in level-shifting circuitry fabrication. Not bad for a $10 investment!■

References

- Pickles, Greg. "Who's Afraid of RS-232?" *Kilobaud,* May 1977, pp. 50–54.
- Ruckdeschel, F.R. "Translating Between TTL and RS-232C Levels," *Kilobaud Microcomputing,* June 1979, pp. 88–90.

DIP-Switch ID	State	Function
SW 8/7	On	Sets word length to seven bits.
	Off	Sets word length to eight bits.
SW O/E	On	Sets parity check for even parity.
	Off	Sets parity check for odd parity.
SW Pdis	On	Enables data parity check.
	Off	Disables data parity check.

Baud Rate	SW4	SW3	SW2	SW1
75	On	On	On	On
110	On	On	On	Off
150	On	On	Off	Off
300	On	Off	On	Off
600	On	Off	Off	On
1200	On	Off	Off	Off
1800	Off	On	On	On
2400	Off	On	On	Off
4800	Off	On	Off	On
9600	Off	On	Off	Off

(Additional settings, as provided by Epson.)

Baud Rate	SW4	SW3	SW2	SW1
300	Off	Off	On	On
1200	Off	Off	On	Off
2400	Off	Off	Off	On
9600	Off	Off	Off	Off

Table 2. Format control DIP switch settings.

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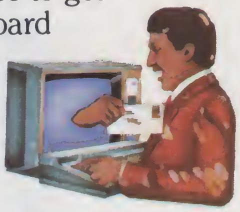

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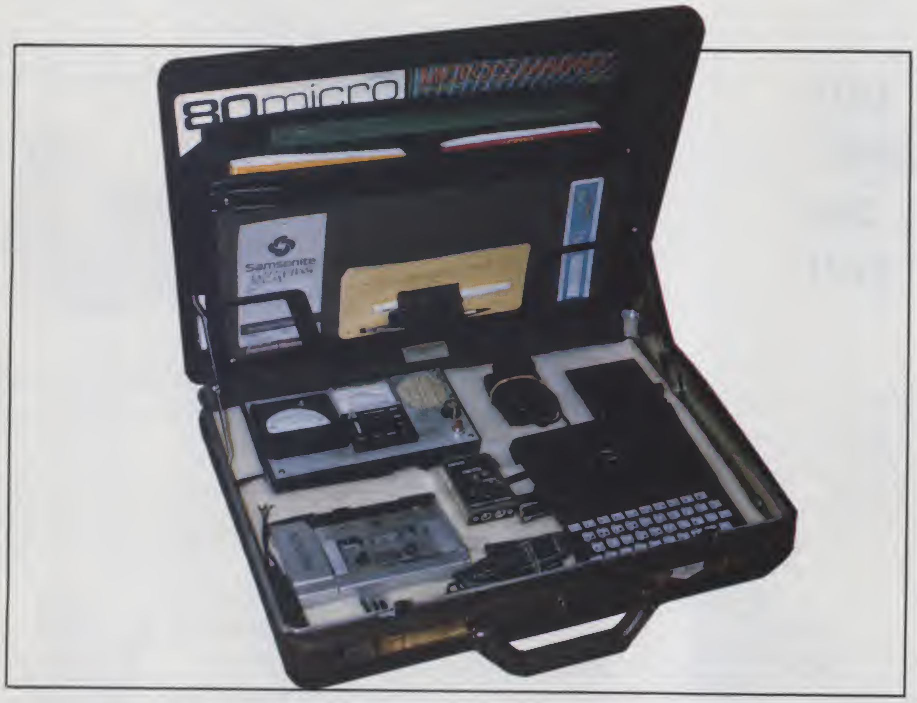
Low-Cost Housing For the ZX-81

Give your ZX-81 a portable home with this Porta '81 project.

By Gary Hearn



Porta '81 provides an attractive home for the ZX-81 (TS-1000).

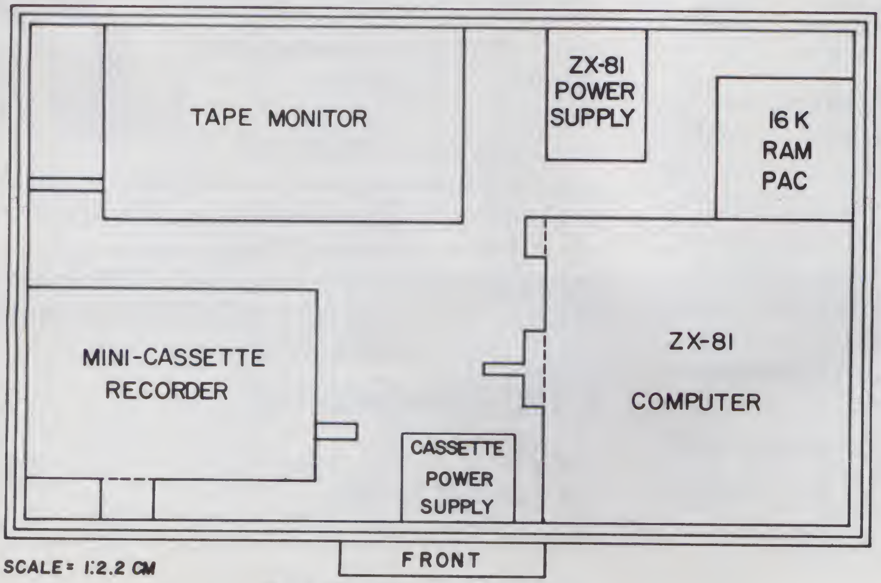


Fig. 1. The components of Porta '81.

Essentially, the ZX-81 microcomputer (now marketed by Timex as the Timex-Sinclair 1000) is a complete computer system regardless of its small size and sometimes limited capabilities.

My familiarity and experience working with the ZX-81 microcomputer has prompted me to write about constructing your own Porta '81 (Fig. 1), a construction that increases the utility and flexibility of the ZX-81 system.

After receiving the ZX-81, reading the documentation and trying several short Basic programs, my respect for this little machine grew tremendously. The ZX-81 is simplicity itself and, from a programmer's point of view, the hardware/software configuration combined with low cost makes this an outstanding value for both the computer novice and the experienced programmer.

Every computer has its own set of strengths and weaknesses. The ZX-81 is no exception, but the strengths do seem to outweigh the weaknesses. Some of the major strengths include:

- Emphasis on design simplicity
- Low cost
- Large user/dealer/service base
- Growing library of prepackaged computer programs
- Small size
- Low-resolution graphics
- Compact Basic interpreter.

Some areas that need improvement are:

- Small keyboard restricting data-entry speed
- Lack of built-in hi-resolution graphics

Address correspondence to Gary Hearn, c/o Microcomputing, *80 Pine St., Peterborough, NH 03458.*

- Limited Basic interpreter capabilities
- Restricted portability

Most, if not all, of these drawbacks are being addressed by either the manufacturer or the growing support industries for the ZX-81. The Porta '81 project described in this article addresses the portability problem.

When your ZX-81 package arrives from the dealer, you will find that it includes several small pieces of hardware and good documentation to get you started. The whole package comes in a box that measures 15½×9 inches and weighs only a few pounds. Doesn't seem like you'd have much of a portability problem, does it? The answer depends on the intended use of the system (e.g., at a kitchen table, for business applications or personal use) and the frequency with which you have to disassemble the system, move it, and reassemble all of the components.

In the long run, frequent disassembly and reassembly of the system is not a good idea, because of the wear-and-tear it causes on the moving and nonmoving components. If practical, the ideal situation is a permanent work station set up in a convenient, but protected, location. However, this is not always possible; Porta '81 takes this into consideration.

The basic ZX-81 system is composed of six modular hardware units connected via a number of unobtrusive cables and wires. To this basic configuration I have added a seventh component—the cassette tape monitor. It has proven to be a great help in creating and maintaining a growing personal library of computer programs and cassette tapes.

The ZX-81 is part of a modular computer system. This is nice if you have to repair only one or two components. The appearance and convenience of a combined system (e.g., a computer or home entertainment system) is great until you have to lose the use of the entire system in order to have one or two defective components repaired.

Modular systems seem to have overcome this problem to a degree, but all of the connecting wires and cables sometimes get in the way. Restricting portability, making an unsightly mess and, in some cases, creating a hazard are some of the problems.

Porta '81 solves this problem by giving your ZX-81 a safe and attractive home, while at the same time increasing the usefulness and flexibility of the system. A list of general construction steps and a table of specifications are shown in Table 1.

Good luck with your Porta '81 construction project. For more detailed construction information on the cassette tape monitor, write me and I'll be glad to help you in any way I can.■

1) Locate and clear work area
2) Assemble ZX-81 as usual and test operation
3) Accumulate working papers, documentation, and compile
4) Accumulate tools and construction materials
5) Purchase or otherwise acquire hard-side case
6) Cut/shape/finish foam rubber inserts
7) Place foam rubber inserts in case
8) Place hardware components in case
9) Reconnect components, power up and retest system
10) File working papers, documentation and supplies in Porta '81
11) Disconnect components (i.e., power supplies and TV monitor)
12) Repack Porta '81 and test under typical travel conditions
13) Reconnect ZX-81 system components
14) Power up system and retest system operating condition

Congratulate yourself on a job well done!

Table 1. General construction steps for Porta '81.

1) Solid lower insert 1.5×12×18.5 inches
2) Finished upper insert 1.5×12×18.5 inches
3) Five-inch Samsonite briefcase with interlock
4) Dimensions of upper insert:

Description	Length	Width	Depth
ZX-81	6.5 (inches)	6.9 (inches)	1.5 (inches)
16K RAM Pac	3.0	3.1	1.5
ZX-81 Power Supply	2.2	3.0	1.5
Cassette Tape Monitor	7.7	4.3	1.5
Mini Tape Recorder	6.1	4.3	1.5
Recorder Power Supply	2.4	2.0	1.5

Table 2. Porta '81 specifications.

Porta '81 Tip Sheet

1) If possible, do not operate the ZX-81 while it is sitting in the foam rubber. This may contribute to heat build-up.
2) The part of the construction that takes the most time is the cutting and shaping of the foam rubber inserts. Through trial and error, I've tried to reduce the time needed for this messy job.
3) Reduce to a minimum the working papers, documentation and programming manuals that Porta '81 must carry.
4) Your Porta '81 does not have to be a briefcase. The case you choose may be larger to accommodate more accessories or components, but the depth must be about five inches to accommodate the largest component and provide for the impact-cushioning foam rubber inserts.
5) You will need at least one or two additional patch cords with the proper plugs to be able to connect the cassette tape monitor. I have found it convenient to carefully separate the cable that came with the ZX-81, and to use the leads separately. The excess cable can be sandwiched between the upper and lower inserts to get them out of the way. You might also want to invest in an extra TV modulator for convenience and a longer cable to connect the ZX-81 and the TV modulator.
6) Follow the manufacturer's recommended procedure for connecting and disconnecting the various components. Disregarding these procedures could damage some of the components (especially the external RAM Pac).
7) Although the Porta '81 travel case is designed to reduce external impacts and shocks, keep in mind that rough handling can cause hardware glitches.
8) If the cassette tape monitor is not necessary for your needs, it may be removed with no effect on the ZX-81's operation. Since the cassette tape monitor is the largest component contained in the Porta '81, removing it also will add a great deal of room for other accessories.■ *G.H.*

Tandy's 100 Reasons to Go Portable

Everything you need to know about the Radio Shack Model 100. . .

By Larry Canale and Jake Commander

An Odd Couple Review

On May 1, 1983, at 3:30 p.m., Microcomputing *assistant editor Larry Canale was handed an assignment: find a Radio Shack Model 100 and review it by 8 a.m. the next morning.*

With nowhere else to turn, he showed up at the doorstep of longtime friend Jake Commander. . .

Can an editor trained in journalism—not in computing—and a technical expert—well-versed in computing—review the Model 100 without driving each other crazy?

Commander, a microcomputing author and programmer, had obtained one of the first Model 100s to be released, and since he'd been putting it through its paces for a few weeks, he was the perfect source for facts.

The following interview was conducted telecommunications-style on a Model 100 and a Model I. Commander's commentary in the conversation provides an informational overview on how to operate Radio Shack's new briefcase portable.

LC: Jake, everyone and his brother is coming out with a portable these days. I keep expecting to read that even McDonald's will be coming out with one. What makes the Radio Shack Model 100 so appealing?

JC: The size of it, for one thing. It's perfect—just the size of an open book. It's perfect for resting on your lap when you're working with it.

LC: That's great—especially if you're lap-oriented. But let's rap about the screen for a split second. How readable is it?

JC: I find it very readable. And to make it easier to read, it has a control for adjusting the angle of the display, so you can always be in a good position for viewing. The display is one of the best features of the Model 100. And it's bigger than the LCDs on most portables.

LC: About the keyboard: I don't have any reservations about that because it looks so impressive.

JC: It is impressive, especially because of the set of eight programmable function keys.

LC: I remember from the demonstration you gave the other night that the function keys are located right below the LCD.

JC: The placement of the function keys is dead right. They're useful there, right below the screen.

One of the function keys, Label, allows you to view what the function of each key is—that information is printed right above the keys themselves.

LC: What about the functions? What advantages do they provide?

JC: The function keys can do some neat things. If you're in the Telcom (telecommunications) mode, you can hit the Label key and see that F1 allows you to view a split screen (the screen is treated as if it were 16 lines deep instead of eight); F2 allows you to download a file from another computer to the Model 100; F3 allows you to upload a file from the Model 100 to another machine; F4 is a toggle between half- and full-duplex; F5, F6 and F7 don't do anything in this mode; and F8 allows you to disconnect from another computer. All that at the touch of a single key.

I didn't get to answer your question about the main keyboard, though. Do you want to ask me again?

LC: Okay. Jake, the Model 100's keyboard seems almost surprising, at least to me. It seems so. . . big for being a portable's keyboard. And it has a nice feel to it. Verification?

JC: The keyboard is one of the things that makes this computer so enjoyable to us. It doesn't feel like a compromise.

So *many portables* (and many not-so-portables) have ended up with a keyboard that reflects a design consideration when the machine was on the drawing board—the design consideration being. . . to save money! The result is usually a crummy keyboard.

This beaut has exactly the right keyboard. Looking at the front, it takes up a little more than half the area. That's the way it should be. After all, every little thing the computer tells you is in response to keyboard input (well, almost everything). So it makes sense to a serious audience to have a nonjoke for a keyboard. . .

Tactile feedback is a bit strange. No click or sensation—other than the key hitting a solid base. But it feels nice to type on, and you can go really fast if you're good (which I ain't). Also, it's the correct pitch. Typists can go a hundred miles an

A Capsule Look At Radio Shack's Model 100

Manufacturer

Radio Shack, Tandy Center, Fort Worth, TX 76102.

Base List Price

$799 for 8K RAM and $999 for 24K RAM.

Standard Features

Eight-line, 40-column LCD with graphics capabilities; 80C85 microprocessor; 32K of ROM, 8K of CMOS RAM (expandable to 32K); built-in, direct-connect modem (Bell type 103); interfacing for audio-cassette recorder, parallel printer, RS-232C devices, bar-code reader; 256-code full ASCII keyboard (which includes eight function keys, four command codes and four cursor-control keys).

Software

The Model 100's six permanently stored programs are Menu, Basic, Text Processing, Telecommunications, Address and Scheduler.

Proportions

Computer weighs three and one-half pounds and measures 11¾ × 8½ × 1⅞ inches.

Documentation

Reference manual and owner's manual.

hour without looking.

LC: I guess you like the keyboard. Should I mention, for fact's sake, that the keyboard is a full ASCII keyboard with 256 codes, four cursor-control keys and four command keys, along with those eight function keys?

JC: It *is* worth pointing out. You can type any darned character you want into the machine. It's not just ASCII, it's ASCII and then some. Not many computers let you type a house or a car into the screen with one key. . . The graphics figures are amazing for a portable.

Those aren't the only goodies, though; you can hit a special key that converts part of the keyboard into a numeric keypad—you know, one of those that goes 789,456,123 and zero at the bottom. Know what I mean?

LC: I know where you're coming from. But let's carry on with the software. Do you think we should throw around a few hints about the six programs stored in the Model 100's ROM?

JC: Yea, verily. One of the many good things about the Model 100 (and it's the combination of all of them that makes this portable so outstanding) is the fact that when you switch it on, you have all these software tools ready to serve you. When you get your machine home (or to the office), it's ready to fly the instant it's switched on. You don't have to worry about getting it out of the store only to find that you should have asked some sensible questions about software support. It's already there.

Awaiting you on power-up is a menu. Contained in that menu: Basic, Text (the mini-word-processor), Telcom, Adrss (a name and address handler) and Schedl (which handles appointments and time schedules). Any one of these applications is selected either by typing in the name at the menu or by placing the cursor over the application of your choice. Couldn't be much simpler.

Including the on/off switch, you can be word processing with the touch of three buttons. How's that for "user-friendly"?

LC: It does sound friendly, even for computer illiterates. But I want you to clear up one thing: The other night, during your demo, you were quick to point out that the Model 100's Text program is a text processor and *not* a word processor.

JC: It's all a matter of definition. By making the point that it's not a full-fledged word processor, I only meant to say that you can't do some of the more esoteric word processor functions. You can't format margins or use fancy window commands and the like.

What you *can* do is type in text (as fast as you can go). The Text program takes care of word splitting, and you can cut out text and reinsert it ("paste" it, as the Model 100 calls it) anywhere else in your text. You can search for a piece of text, and you can step through your text by character, word, line, screen or by the entire file. All it lacks is a "write" command.

LC: What about Telcom? For nontechnical people, telecommunications is one of the scariest aspects of this field. But you were working with Telcom the other night, and it seemed almost too easy. Is there something wrong? It shouldn't be that easy.

JC: It's true—the Telcom package *is* easy. Just for this article, maybe I should mention how we're conducting this talk. I'm logged into the computer you're sitting at, via the Telcom package, through the internal phone lines of my own house. I just hit the "terminal" function key and I go into terminal mode and converse with you at your computer. That's pretty easy.

It might be a little harder logging onto a network such as CompuServe or Dow Jones. The normal procedure is: load the communications software into your computer, dial the number, wait for the tone and then crank the software into action. With this little beast, you go into Telcom package, let it find the number of the information service from a file you've already stored and let it dial the number and log on *automatically*. If you save your ID and password, it will type even these on your behalf.

LC: Have you worked with Basic much in the last few weeks?

JC: Quite a bit. I've already written a simple program that does a word count of a file written in the text processor. (This points out one of the things not included in that package, but shows how easily it's dealt with.)

The Basic is powerful; it contains such features as

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sound and high-resolution graphics (you can set/reset any of LCD's 15,360 pixels).

The file-handling is especially neat, and it points out one of the specialties of the machine. All files in the Model 100 are stored in RAM. This is backed up by battery, so you can never, never lose a file. These files are saved as if they were going to a disk.

The files are viewed from the menu like a disk directory and they can be killed the same way. And they can be accessed from Basic as if they were disk files.

So Basic can do whatever the heck it likes with all the information in the computer. Just open the file and go for it.

LC: Should anything be said about the Adrss and Schedl programs?

JC: Let me just say a couple of things. First, the address-handler is neat in that you can find names and addresses just like a Rolodex sort of thing. But if you want to get *real* clever, you can use that same file (name/address), go into the Telcom package and let *it* do the dialing. So you don't even have to pick up the phone to call somebody (well, I guess you have to at some point; otherwise, what's the reason for calling?).

The scheduler is a dedicated database-type program (similar to Adrss), except that it handles whatever you want it to. If you put a file into the computer in a format specific to your needs, you can tailor its use just for you. For instance, one of those characters you can type in is a telephone symbol. You can enter this into the file that's handled by the scheduler and check to see what calls you should be making at, say, 3 p.m. Then the poor blasted machine is expected to place the call! Next thing you know, the machine will be clinching all kinds of business deals without you knowing it.

LC: You seem tickled by the fact that the Model 100 saves files without disks and disk drives. Well, it's battery-powered, but even when it's off, it isn't really off, is it? Isn't it comparable to when a human goes to sleep at night with everything he's learned in his brain, and he wakes up in the morning and still has all that information (as long as too much hasn't been crammed into his memory)?

JC: Good analogy. I suppose it doesn't *really* get switched off. At least the memory doesn't.

The processor is off, but the RAM (8K expandable to 32K) is kept alive by a secondary set of batteries. These are rechargeable and are kept topped up by the "daytime" power supply (whether that be a main set of four batteries or an AC adapter).

By the way, I wouldn't take the sleep analogy *too* far; I haven't checked to see if this machine dreams. Maybe I should creep up on it in the middle of the night to see if I can catch any Rapid LCD Movement. Then I'll ask it what it was dreaming about. Maybe that could be a new way of software development. I could dump the poor thing's brains right in the middle of a nightmare.

LC: An idea worth investigating, surely. Anyway, the other night, you demonstrated how the Model 100 goes off by itself if it hasn't had any keyboard contact in a set period of time.

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B. TOUCH DESIRED KEY ON VIP to be programmed.
C. INPUT UP TO 8 CHARACTERS from computer keyboard.
D. TOUCH PROGRAM KEY AGAIN to stop programming. THAT'S IT!
E. REPEAT A-D for all 31 keys
F. TOUCH SHIFT LOCK KEY ON VIP
G. TOUCH PROGRAM KEY ON VIP and repeat steps B-E.
P. LED exhibits "P" and decimal point indicating that you are programming a key in shifted mode.
H. TOUCH PROGRAM SELECT KEY
LED changes to reflect which 1 of 4 keyboards you're programming. 1 2 3 4
I. REPEAT STEPS A-G, H till all 4 keyboards in memory are programmed.

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"This beaut (the Model 100) has exactly the right keyboard."

Inside Model 100: built-in modem, 80C85, 32K ROM, 8K CMOS RAM. . .

JC: Another goodie to point out. Many people are turned off (maybe rightfully so) by the sensitivity of micros to their external environment. As this environment usually consists of human beings, it's somewhat of a disadvantage to have these machines losing all their marbles if you sneeze or rub your feet too hard on a carpet (or whatever it is that freaks out the machine in the middle of a long session of typing).

The good ol' Model 100 doesn't care, does it? It can't lose files because the RAM is never switched off (by accident or by design), but it will actually switch itself off after a predetermined length of time (which you can alter at will). This machine actually gets bored with you if you don't give it something to do.

Seriously, this is a great feature. It doesn't matter if you forget to save a file; it doesn't matter if you don't even *think* in terms of files. The computer will always have your last input saved somewhere in its innards, ready to splurge all over you the next time you switch on.

Once again, I think this removes some of the fear that people have about micros. It's all very well to tell them that computers won't *hurt* them. Of course, it depends upon what your definition of pain is. When I spend three hours typing a masterpiece into a micro, then the thing glitches itself into oblivion (taking my work with it), I *hurt*.

LC: It happens to the best of you, Jake. But let's move on. Interfacing?

JC: I'll tell you what—I'm starting to realize how many aspects there are to this machine. OK. Interfacing. The interfacing of any import is going to be performed via the RS-232 port at the rear of the machine. There are lots and lots and lots (and I'm not even exaggerating) of peripherals that use the RS-232 protocol to allow computers of all kinds to use them.

You can feasibly connect the Model 100 with such banal things as printers (although there's a parallel port for that) or other computers (for example, special ones, like graphics computers) or plotters or whatever. You could hook it up to a robot arm and things like that.

If it (any device) has an RS-232 connector, you can drive it with the Model 100. I have a feeling that you won't believe some of the things this little device will be driving within the next 12 months, as people realize it and start to experiment.

Apart from the RS-232 port, there's the parallel printer port, the cassette port, the phone port, a bar-code reader port, and two multipin connectors sneakily hidden in a compartment underneath the machine. Now aren't you sorry you asked that question?

LC: Certainly not. I think you did well in answering a pretty open-ended query. How about the Model 100's CPU?

JC: The CPU is an 8085. To be more precise, it's an 80C85. The 8085 is the same chip as an 8080, except that it has some special interrupt-driven features that are useful in a portable. You can use the interrupts to do predetermined things at a special cue. E.g., you can have a Basic program execute a special subroutine at a preset time without your program having to constantly "look at the clock."

This kind of interrupt-driven procedure is dealt with in its stride by the 8085. The 80C85 is a CMOS version of the 8085. This means that it consumes hardly any power, which is exactly as it should be in a portable.

LC: Finally, Jake, what about possible future upgrades of the Model 100?

JC: I took a peek at all the Basic commands in the ROM. What did I find? DSKI$ and DSKO$ commands. These are the same commands as used on the Color Computer to perform disk I/O, so I don't think I'm stretching it too far to suggest that disks are a certainty for this thing.

There's also a WAND command; what could that be for? For the bar-code reader, you'd think. I'd be happy to put money on it.

In the meantime, third-party developers would be crazy to miss this opportunity. There will be a lot of hardware and software for the Model 100 coming out of the woodwork. I already know of a plan to develop a bubble-memory backup for it. That's without thinking too hard. I'm sure many creative people will be working on some goodies for this machine. The bar-code reader especially could have interesting possibilities. Enough for you?

LC: I think so. I also think you've got a good handle on the Model 100.

JC: I don't *really* have a handle on my Model 100. It's the one thing it lacks.■

Fine-Tune Your Monitor

Get your color TV or monitor into register with this convergence test program and your Apple II.

By John L. Forbes

How often have you wished you had a crosshatch and dot generator in order to adjust the convergence of your color television receiver? If you have an Apple II (with tape Applesoft) or an Apple II Plus, and you use a TV or color monitor, then you have the generator right there. All you need is some software to make it work.

But why do you need a dot and crosshatch generator?

The standard color television picture tube has a screen made up of about one million phosphor dots, which, when struck by electrons, emit three colors of light, depending upon the type of phosphor: red, green and blue.

When these three types of phosphors glow in equal intensities, the human eye is fooled into seeing white light, and when only red and blue are combined in equal intensities, the resulting color is called magenta, a reddish purple. Blue and green make cyan, and red and green make yellow. Red, blue and green are called "primary" colors, while cyan, yellow and magenta are their respective "complementary" colors.

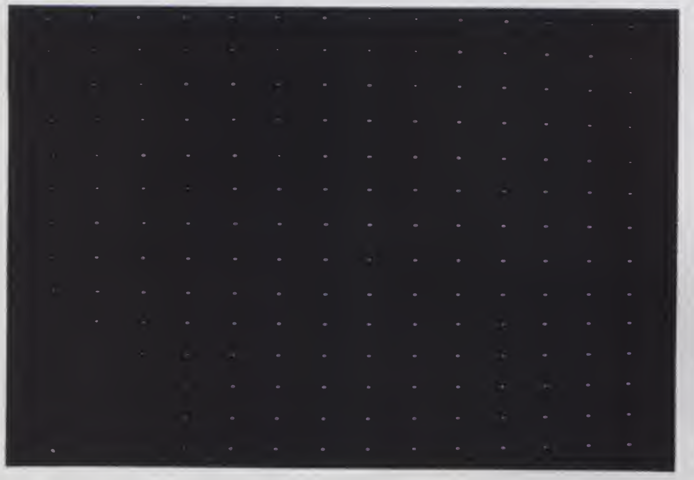
(Color television works on the "additive" mixing of color light, whereas the colors of paint and color printing rely on the "subtractive" mixing of pigments. In the additive process of mixing colored light, red, blue and green are the "primary" colors, and when they're mixed in equal amounts, they make "white." In the subtractive process of mixing colored pigments, red, blue and yellow are the "primary" colors, and when they're mixed in equal amounts, they make "black.")

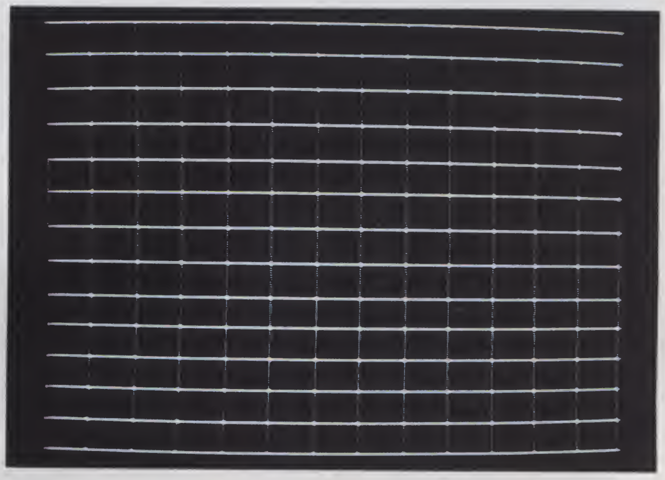
By varying the combinations and intensities of these six colors, almost any possible color can be reproduced by a TV receiver or color monitor.

Most color television receivers and monitors use picture tubes containing three electron guns, one each for the three color information signals. In order for the picture to be clear and sharp, the respective electron beams emitted by these guns must strike the phosphor "plate" in a triangular pattern, or triad; the red beam strikes the "red" phosphor, the blue beam strikes the "blue" phosphor and the green beam strikes the "green" phosphor.

If for any reason the three beams do not strike their respective phosphor dots, the picture will be "out of regis-

Address correspondence to John L. Forbes, 21832 99th Ave. S.E., Snohomish, WA 98290.





Dot pattern and crosshatch pattern generated from convergence test signal program.

ter." That is, you will see a blurred, fuzzy picture with color smearing, causing red, blue and green ghosts, and whites will not be pure.

Making Adjustments

Therefore, when a TV set or color monitor is out of register, adjustments must be made to realign the electron beams so that they strike the proper phosphor dots. The process by which the electron beams are focused onto the proper phosphor dots is called "convergence." The tool used to make these adjustments easier is called a "dot/bar generator."

The convergence adjustments are not difficult but must be done with care. Because the manufacturer of each brand of TV set and color monitor may suggest different procedures for convergence, I recommend that you follow the procedure found in the service manual for your particular set.

Nonetheless, the steps below make up a general procedure you can follow:

1. Turn on the TV set or monitor and allow it to warm up for about 30 minutes before you make any adjustments.
2. While the TV set is warming up, load and run the TEST.SIG program.
3. After the set has warmed, press "CH". You do not need to press the return key. The program will enter the high-resolution graphics mode and draw a grid pattern called the crosshatch. You will notice the pattern will have blue and yellow or green colors in it, depending upon the setting of the chroma phase adjustment of your set. (The reasons for this lie in the way the Apple generates the high-resolution graphics colors; they're beyond the scope of this article.) To eliminate this, turn the color intensity control of your set all the way counterclockwise (down) so that only a white pattern is visible.
4. Press <ESC>. This will return you to the menu.
5. Press "WH" to get the full-field "white" signal for the purity adjustment. If the white is relatively pure, or to your liking, you may skip steps 6 and 7.
6. Turn down the blue and green bias controls (check your owner's manual for their locations) so that the screen shows only red. On the neck of the picture tube near the yoke coil are three tabbed metal rings called the "purity rings." Adjust these rings for the purest red you can get. Once you have obtained a pure red over the en-

This photo illustrates the representative colors of the color bar pattern.

Listing 1. Apple program that checks convergence and color fidelity in television receivers.

```
1   REM **************************
2   REM ** PROGRAM TO GENERATE **
3   REM ** CROSSHATCH PATTERN  **
4   REM * DOT PATTERN AND COLOR *
5   REM **    BARS TO CHECK    **
6   REM **   CONVERGENCE AND   **
7   REM **  COLOR FIDELITY IN  **
8   REM ** TELEVISION RECEIVERS *
9   REM **                     **
10   REM **  BY JOHN L. FORBES **
11   REM **                     *
12   REM **                    **
13   REM *                      *
14   REM **                    **
15   REM **                    **
16   REM ************************
17 :
18 :
19 :
20   REM  INITIALIZE AND
21   REM  FORMAT SCREEN
22 :
23   HOME
24   GOSUB 173
25   VTAB 10
26   PRINT "CROSSHATCH, DOTS, COLORBARS, OR WHITE              (CH,DO,
      CB,WH)? "
27   PRINT : HTAB 9: PRINT "PRESS <RETURN> TO END."
28   VTAB 11
29   HTAB 27
30 Q1$ = "":Q$ = ""
31   GET Q1$: PRINT Q1$
32 Q$ = Q$ + Q1$
33   IF  ASC (Q$) = 13 THEN  GOTO 159
34   IF  LEN (Q$) < 2 THEN  VTAB 11: HTAB 28: GOTO 31
35   IF  LEFT$ (Q$,2) = "CB" THEN  GOTO 104
36   IF  LEFT$ (Q$,2) = "CH" THEN  GOTO 44
37   IF  LEFT$ (Q$,2) = "DO" THEN  GOTO 44
38   IF  LEFT$ (Q$,2) = "WH" THEN  GOTO 220
39   GOTO 25
40 :
41 :
42   REM SET HIGH RESOLUTION (HIRES) GRAPHICS MODE, PAGE 2
43 :
```

More

Listing continued.

```
 44  HOME
 45  HGR2
 46 :
 47 :
 48  REM SET HIRES COLOR TO WHITE
 49 :
 50  HCOLOR= 3
 51 :
 52 :
 53  REM  CREATE DOT PATTERN
 54 :
 55  IF  LEFT$ (Q$,2) = "DO" THEN  GOTO 192
 56 :
 57 :
 58  REM  SET UP THE HORIZONTAL LINES
 59 :
 60  FOR A = 0 TO 192 STEP 192 / 13
 61 :
 62 :
 63  REM  PLOT THE HORIZONTAL LINES
 64 :
 65  HPLOT 0,A TO 279,A
 66  NEXT A
 67 :
 68 :
 69  REM SET UP THE VERTICAL LINES
 70 :
 71  FOR B = 0 TO 280 STEP 280 / 13
 72 :
 73 :
 74  REM  PLOT THE VERTICAL LINES
 75 :
 76  HPLOT B,0 TO B,191
 77  NEXT B
 78 :
 79 :
 80  REM  PLOT THE BORDER AROUND THE GRAPHICS SCREEN AREA
 81 :
 82  HPLOT 0,0 TO 279,0
 83  HPLOT 279,0 TO 279,191
 84  HPLOT 279,191 TO 0,191
 85  HPLOT 0,191 TO 0,0
 86 :
 87 :
 88  REM  GO TO KEYPRESS
 89  REM  CHECK ROUTINE
 90 :
 91  GOSUB 165
 92 :
 93 :
 94  REM  RETURN TO MENU
 95 :
 96  TEXT : GOTO 23
 97 :
 98 :
 99  REM  COLOR BAR ROUTINES
 100 :
 101  REM  BEGIN WITH FULL
 102  REM  SCREEN GRAPHICS
 103 :
 104  TEXT : HOME : GR : POKE  - 16302,0
 105  COLOR= 15: REM   WHITE
 106  FOR X = 0 TO 5
 107  GOSUB 143
 108  NEXT X
 109  COLOR= 13: REM GOLDEN YELLOW
 110  FOR X = 6 TO 10
 111  GOSUB 143
 112  NEXT X
 113  COLOR= 6: REM  CYAN
 114  FOR X = 11 TO 15
 115  GOSUB 143
 116  NEXT X
 117  COLOR= 14: REM YELLOW-GREEN
 118  FOR X = 16 TO 20
 119  GOSUB 143
 120  NEXT X
 121  COLOR= 1: REM  MAGENTA
 122  FOR X = 21 TO 25
 123  GOSUB 143
 124  NEXT X
 125  COLOR= 9: REM  RED-ORANGE
 126  FOR X = 26 TO 30
 127  GOSUB 143
 128  NEXT X
 129  COLOR= 2: REM  BLUE
 130  FOR X = 31 TO 35
 131  GOSUB 143
```

More

tire screen, you can go to the next step.

7. Now, turn up the blue and green bias controls, which you had previously turned down, until you get a white picture on the screen. This will be a subjective adjustment, since white will be determined by a subconscious comparison with neighboring colors (i.e., walls, curtains or drapes) and ambient light levels and hues within the room the set is in.

8. Press the escape key and then "CH" for the crosshatch pattern. Depending upon how badly out of convergence your set is, you will notice red, blue and green horizontal and vertical lines. Adjust the convergence magnets, located on the convergence coil mounted on the picture tube neck (again, check your manual). Also, adjust the convergence controls to merge these varicolored lines into solid white lines. This takes time, so be patient.

9. After you make the crosshatch as close to white as you can, press the escape key and then "DO" to get the dot pattern. You can then use this pattern to "fine tune" your adjustments.

10. Repeat steps 8 and 9 until you get the best convergence obtainable.

11. Next, press the escape key to return to the menu; then press "CB" to get the full-field color bars. These bars are not NTSC (National Television Systems Committee) color bars; they are an approximate color reproduction of the standard full-field color bar signal. With the aid of these bars you can turn up the color intensity control of your set and *readjust* the color. The NTSC color bars should be (as seen left to right on a TV screen) white, yellow, cyan, green, magenta, red, blue and jet black.

The Program

TEST.SIG was written because I had a need to make convergence adjustments on my home TV console and didn't want to spend money on a dot/bar generator.

Since I owned an Apple II, which has fairly good high-resolution graphics, I thought that I could program it to be a signal generator. With the aid of this program I was able to get a good convergence from my set. On the TV set that I use as my Apple video screen, the color bars appear close to NTSC color bars, but on different sets or high-quality broadcast monitors, color will vary.

TEST.SIG will run on any Apple II

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Listing continued.

```
132  NEXT X
133  COLOR= 0: REM  BLACK
134  FOR X = 36 TO 39
135  GOSUB 143
136  NEXT X
137  VTAB 23
138  GOTO 150
139 :
140 :
141  REM  DRAW VERTICAL BARS
142 :
143  VLIN 0,47 AT X
144  RETURN
145 :
146 :
147  REM  GO TO KEYPRESS
148  REM  CHECK ROUTINE
149 :
150  GOSUB 165
151 :
152 :
153  REM  RETURN TO MENU
154  TEXT : GOTO 23
155 :
156 :
157  REM  END OF PROGRAM
158 :
159  TEXT : VTAB 23: HTAB 14: INVERSE : PRINT "PROGRAM END";: NORMAL
   : END
160 :
161 :
162  REM  CHECK KEYBOARD FOR KEYPRESS
163  REM RETURN IF ESCAPE PRESSED
164 :
165 K =  PEEK ( - 16384): IF K <  > 155 THEN  GOTO 165
166  POKE  - 16368,0
167  RETURN
168 :
```

More

with Applesoft Basic and minimum 24K RAM memory.

In the program listing, lines 23–39 comprise the input routine. The get command in Applesoft accepts only one string character from the keyboard. Lines 32–34 set up a checking routine that allows a two-keystroke entry without resorting to pressing the return key.

Another routine which may need explanation is the Keypress Check routine. Location $C000 Hex (−16384 decimal) contains the keyboard data byte for the Apple II. When a key is pressed, this location will contain that key's value. Line 165 sets variable K equal to the value found in this memory location. If it is equal to 155 ($9B), then the escape key has been pressed. In order for the Apple to accept any more keyboard data, we must clear the keyboard strobe. Line 166 does this for us.

Once you've keyed in this program and saved it to tape or disk, you'll have one noncomputer utility in your program library that you will find useful time after time. It should save you the price of a service call . . . and strained eyes.■

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Listing continued.

```
169 :
170  REM  PRINT WHITE BACKGROUND
171  REM  THEN PRINT OVER IT
172 :
173  INVERSE
174  FOR X = 1 TO 7: PRINT "                                        ":
      NEXT X
175  VTAB 2
176  HTAB 2
177  PRINT "CROSSHATCH, COLOR BAR, DOT GENERATOR"
178  HTAB 19
179  PRINT "BY"
180  HTAB 13
181  PRINT "JOHN L. FORBES"
182  HTAB 8
183  PRINT
184  HTAB 11
185  PRINT "BY JOHN L. FORBES"
186  NORMAL
187  RETURN
188 :
189 :
190  REM  PRINT HIRES DOTS
191 :
192  FOR A = 0 TO 280 STEP 280 / 13
193  FOR B = 0 TO 192 STEP 192 / 13
194  HPLOT A,B
195  NEXT B
196  NEXT A
197  FOR A = 0 TO 280 STEP 280 / 13
198  HPLOT A,191
199  NEXT A
200  HPLOT 279,191
201  FOR B = 0 TO 192 STEP 192 / 13
202  HPLOT 279,B
203  NEXT B
204 :
205 :
206  REM  GOTO KEYPRESS
207  REM  CHECK ROUTINE
208 :
209  GOSUB 165
210 :
211 :
212  REM  RETURN TO MENU
213 :
214  TEXT : GOTO 23
215 :
216  REM  WHITE SCREEN ROUTINE
217  REM  FOR CHECKING SCREEN
218  REM  PURITY.
219 :
220 BL$ = "
221  HOME
222  INVERSE
223  FOR X = 1 TO 24
224  PRINT BL$
225  NEXT X
226  NORMAL
227 :
228  REM  GO TO KEYCHECK ROUTINE
229 :
230  GOSUB 165
231 :
232 :
233  REM  RETURN TO MENU
234 :
235  TEXT
236  GOTO 23
```

```
A     60, 65, 66, 192, 194, 196, 197, 198, 199
B     71, 76, 77, 193, 194, 195, 201, 202, 203
BL$   220, 224
K     165
Q$    30, 32, 33, 34, 35, 36, 37, 38, 55
Q1$   30, 31, 32
X     106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 143, 174, 223, 225
```

Listing 2. Variable listing; shows which line numbers contain which variables.

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Tank Commander

Creating a fast-action arcade-type game on your computer is a valuable learning experience, as you gain familiarity with your hardware and pick up some invaluable programming tricks. It's also a lot of fun!

By Clem Pepper

When I bought my Heath H89, it was not with the intent of writing arcade-type games. But as time passed and I gained experience with Basic and the H89's terminal capabilities, I became increasingly intrigued with the notion of putting together an action game of my own.

My purpose in writing this article is not to provide another game, but rather to relate some of the experiences I encountered as I struggled through a task which turned out to occupy much of my free time over a two-month period.

Tank Commander is a game of strategy in which a group of three bombers fly in from the left while a similar group of three fighters converge from the right, launching an attack on a tank situated near the screen's bottom (rows 21 and 22).

As the planes approach, sticks of bombs are dropped and clusters of rockets are fired in a two-pronged attack on the tank.

It is the commander's task to evade these threats while shooting down the attacking aircraft. Unfortunately for him, whenever he shoots down the third aircraft of a group, another group appears and, compounding his difficulties, his tank makes a side shift to the left that may or may not place it in line with an unavoidable hazard. The opening action is depicted in the screen portrayal of Fig. 1.

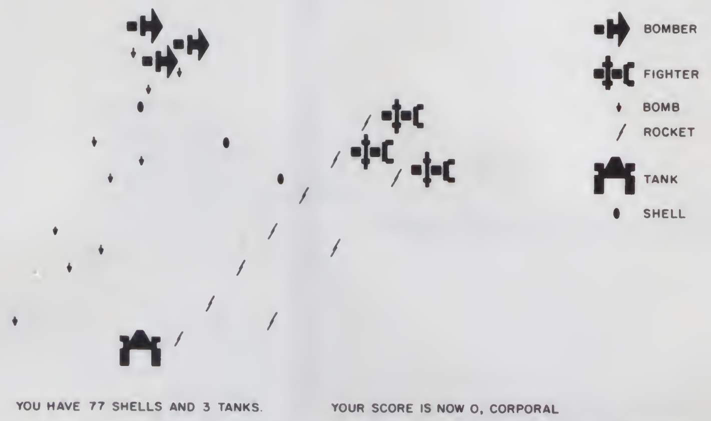
The tank commander is awarded battlefield promotions. Starting out as corporal, he has the potential to advance all the way to general. Because Tank Commander is written in Basic, it is not a fast-action game, but this doesn't mean that making it all the way to general is a snap.

I hope that some readers will want to translate Tank Commander to their own machines, so I'll give a summary of those Heath screen functions important to the game.

Heath's Screen Features

The screen format is 24 lines by 80 characters. In addition, there is a 25th line which functions as an independent, on-line terminal. A number of terminal features are accessed by means of escape sequences. These include clearing the screen, positioning the cursor, entering and exiting the graphics mode, entering and exiting inverse video, enabling and disabling the 25th line, and enabling and disabling the cursor.

The capability to save an instructed-cursor position before going to the saved position in the execution of a subroutine is of particular importance, even though the cursor appearance is inhibited. A tabulation of the escape sequences and their definitions is provided in Table 1. The sequences are listed in statements 10–27 of the program.



```
YOU HAVE 77 SHELLS AND 3 TANKS.          YOUR SCORE IS NOW 0, CORPORAL
```

Fig. 1. What you will see on your screen when playing Tank Commander. The oval objects are tank shells. Up to three may be "airborne" at a time. There are five angles of fire available.

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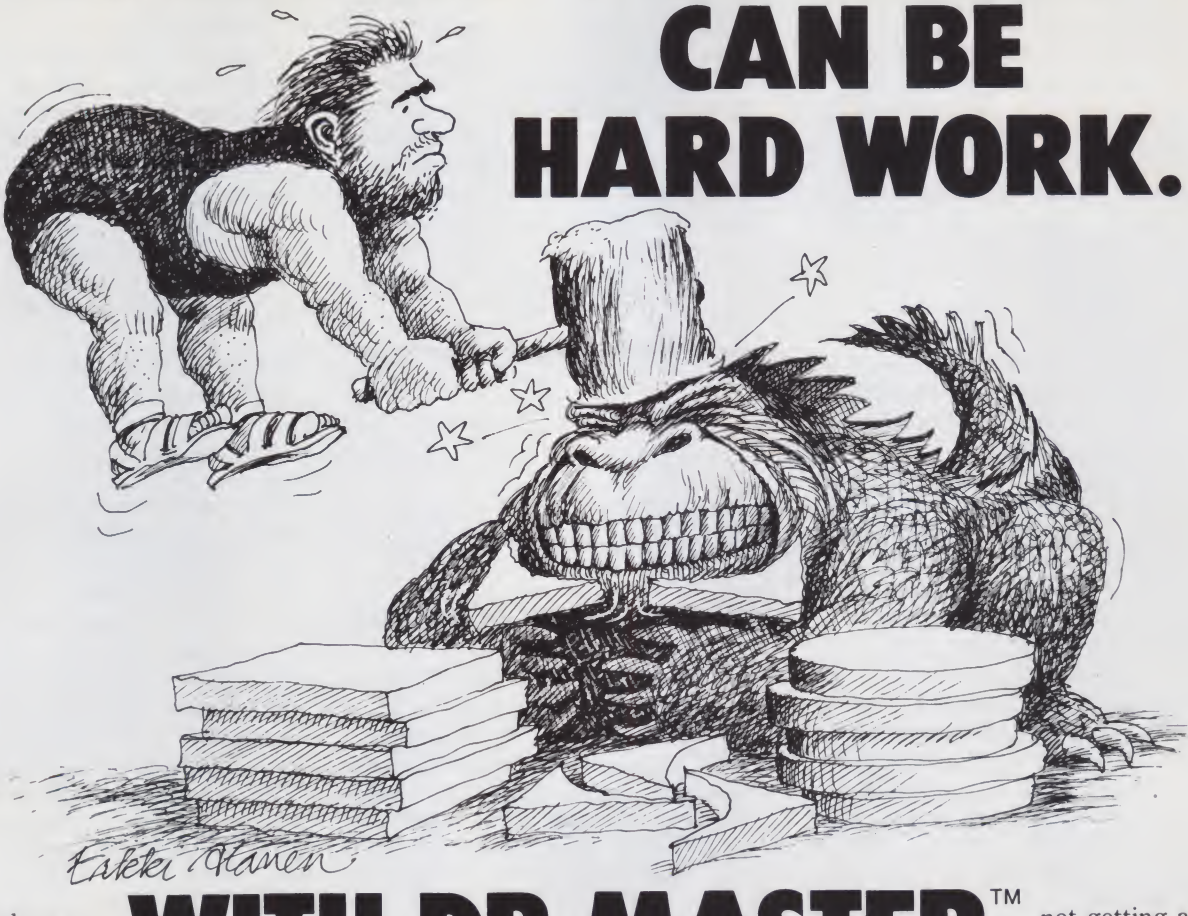

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If you read the Heath manual, the listings as written will appear differently than in the listings published here. For example, a Heath listing for cursor positioning may read as:

```
100 PRINT CHR$(27);CHR$(89);CHR$(32);
  CHR$(38);"String."
```

In Listing 1, you will see similar statements written as:

```
100 PRINT Y$;CHR$(32);CHR$(38);"String."
```

Another item that you may notice in the listing is statement 33: N$ = C$ + C$ + C$. What, you will wonder, can be the meaning of this? Well, statements 32 through 38 save a lot of memory in the subroutines for drawing the planes, bombs and rockets on the screen. To see this, take a quick look at 8830 in the rocket subroutine. Notice the appearance of B$;B$;B$ in this. B$ is a cursor instruction to move down one row on the screen.

Learning that M$ = C$ + C$ performs just like C$;C$ was a breathtaking discovery for me. It came about when I was struggling for a way to blank the previously fired tank shell. I got to wondering . . . what if . . . and sure enough, it did. It pays to experiment. C$, as you recall, is a cursor instruction to move one column to the right. I wrote definitions for C$ because there are an awful lot of them in this program, and one of the problems I faced as I approached the program's completion was a shortage of memory, which reminds me—don't attempt to run this with less than 14K of free memory.

The Heath terminal provides 33 graphic symbols. That is what the manual tells you and defines. In some ways you might say there are really 66, because for each there is a corresponding symbol in inverse video. This program takes advantage of that in the construction of the bomber aircraft.

I have listed a number of string functions in Table 2 and some variables in Table 3 as references you can use as needed while working your way through the program.

In Fig. 2, I've attempted to show the program's sequence of operations by the use of a structured flowchart. If you have looked ahead, you've seen that the program listing deviates from standard procedure: it is not in numerical order by statement number. But it's all there; I guarantee it.

Program Operations

The program operates with a large number of subroutines that I worked up while progressing stage by stage through its design. The listing as shown is easier to follow than it would be if printed in the conventional manner. The flowchart and the program listing are related—that is, in progressing through the flowchart you should be able to follow along in the listing.

The program loops between the two points labeled "A" in the leftmost column of the flowchart. Tasks to be performed are carried out largely through subroutine calls in response to flags. Task activity is depicted by a subtask flow to the right, terminating in a return to the primary loop.

> The listing as shown
> is easier to follow
> than it would be if printed
> in the conventional manner.

A confession: I did not write the program in either the order of the flowchart, or the listing. I began with the aircraft, moved on to the tank and then to the tank's gun-firing, which gave me problems with memory—what you see in the listing is not what I began with. At this point, I created a second filename for the program and began work on the bomb drop.

The problem was length. I had a routine that covered only three of the five firing angles that I was after, and was four times the length of the routine you see now. I simply had to work out a more efficient code. Because the bomb and rocket routines only served to lengthen the program's cycle time and didn't offer a solution to my memory problem, I found it expedient to work with these routines in a separate file.

Eventually, as you can see, I worked out the difficulty. I shaved some 4000 bytes from the program by going back and reassessing what I had done.

The program begins by printing the current status of the game on the screen's 25th line. This is followed by a series of flags to be read. On the program's maiden pass all of these will equal zero and be ignored.

Creating the Graphics

The first graphic to be constructed was the tank—probably the simplest task in the program. If you are following along with the listing, you will see 150 GOSUB 500. 500 provides a print instruction terminating in a cursor position save and another Gosub to 2000.

At 2000 the first instruction is to print K$. This brings the cursor to the required screen location. The instruction segment ending at "f" draws the upper half of the tank. The repeated K$ returns the cursor to TP, B$ drops the cursor one row, and Presto!—the lower half of the tank is drawn. So now we have a tank ready for action.

My original plan called for a single tank. When it got zapped, that was it. However, I saw that would not make for much of a game, so I upped the number to three, then modified the graphics so the player would be reminded of his tank standing.

The two decision blocks that follow will be ignored for some time, since they have no function until an entire group of planes has been shot down.

A$ = CHR$(27) + "A	Move cursor up one row
B$ = CHR$(27) + "B	Move cursor down one row
C$ = CHR$(27) + "C	Move cursor right one column
D$ = CHR$(27) + "D	Move cursor left one column
E$ = CHR$(27) + "E	Erase screen
F$ = CHR$(27) + "F	Enter graphics mode
G$ = CHR$(27) + "G	Exit graphics mode
H$ = CHR$(27) + "H	Move cursor home (32, 32)
J$ = CHR$(27) + "j	Save cursor position
K$ = CHR$(27) + "k	Cursor to saved position
KL$ = CHR$(27) + "K	Erase to end of line
P$ = CHR$(27) + "p	Enter reverse video mode
Q$ = CHR$(27) + "q	Exit reverse video mode
X1$ = CHR$(27) + "x1	Enable the 25th line
X5$ = CHR$(27) + "x5	Disable the cursor
Y$ = CHR$(27) + "Y	Enable direct cursor addressing
Y1$ = CHR$(27) + "y1	Disable the 25th line
Y5$ = CHR$(27) + "y5	Enable the cursor

Table 1. Listing of Heath Escape Sequences employed in Tank Commander and their definitions.

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The next activity is to construct the two groups of aircraft.

Where to Begin

When I first began thinking of Tank Commander, I wasn't sure how to begin. I started out with a pathetic stick figure of an airplane that I learned to move across the screen with a simple for-next loop. I then picked a point near the lower left of the screen from which bullets would be fired at the plane. Sure enough, I could send projectiles right through the plane very neatly, though the overall action was not swift by any standard. I could see right there that the speed limitation of Basic would have to be compensated for to make the game interesting. With a little more effort, I contrived a compare statement that would look for a match between the plane's coordinates and the bullets. If a match is found, the console bell rings and a big fat "X" at the point of intersection is drawn.

Then I learned about Ed-A-Sketch, a program available from The Software Toolworks in Sherman Oaks, CA. I bought it, and it turned out to be helpful in creating graphics for the two groups of planes, the bombs and the rockets.

Ed-A-Sketch, along with additional effort in simplifying the statements generated by it, allowed me to confine the instructions for the printing of an entire group of three aircraft to a single statement—a considerable advantage.

The task confronting me was not only to create the original groupings of these moving objects across my screen's sky, but to account for losses as the Commander shoots them down. We end up with a total of 32 graphics constructs when you consider that for each screen position created, a blanking of same is required as that group moves from point to point across the screen.

Yes, indeed, the terminal remembers that there were three planes beginning with row 34 and column 32 and, unless you do something about it, you will observe a peculiar streaming behind your planes as they make their way across the screen. This is why you see in your perusal of the flowchart that the first task calls for the blanking of the two groups. Two print sequences are required for any screen motion: the first to draw the pattern, the second to erase it. Sometimes, as in the case of the planes, I found it more expedient to begin with a blanking instruction.

The next operation is to increment the counters that advance the planes in their flight. You should have seen a reference to a random-offset generator in the initialization task list. It is there to insert variability in the planes' first appearance in the sky, so the tank commander won't lapse into the security of routine.

Next, a position check is made; if the group is at the screen limit, the counters are reset so that the game can continue. I put a lot of thinking into how to do this before being struck by the obvious: reset the I and J counters.

There has to be some way to inform the program of plane losses due to hits by the tank gun. The eight possibilities for the three bombers are defined by the 0-1 status of flags BH1, BH2 and BH3. On the initial pass, all flags are 0 and a gosub to 5000 will print a bomber group, setting flag FA = 1 as we do so.

Now, with the aircraft in the sky, we have to look at conditions for launching an attack on the tank. Since there is little virtue in expending resources on bare ground, the program makes the decision to bomb or rocket on the basis of the tank's position. Also, we would like the missiles to descend in a pattern sufficiently dense; this keeps the tank commander on his toes while permitting an avenue of escape.

Dropping the Bomb

The bomb and rocket subroutines are so similar that one discussion will suffice for both. The major difference is the straight descent of the bombs versus the slanted descent of the rockets. Also, the bomb pattern occupies three rows, while the rocket spans four. Bombs drop at a five-column spacing, rockets with four. These variables can be easily changed should you desire.

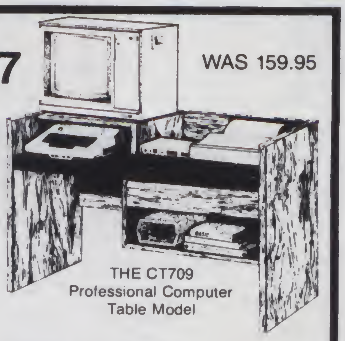
As part of the design effort, I sketched up a variety of bomb drop patterns on a row-column distribution. In my original concept, I had a number of flags extending completely across the screen. Then one evening while sketching falling arrows on a map of my computer's screen, it dawned on me that there would never be more than four bomb clusters on the screen at a time—when the fifth appeared the first would be done and gone. Thus came the wrap-around scheme for recycling the drop variables. This, in turn, directed me back to the tank gun and the contraction of its length by a factor of four.

Two counters, DC and EC, increment and decrement, respectively, are on each program loop. At integer spacings, a test is made of the tank's position relative to the aircraft, and on the first occasion favoring an assault, a flag is set. What the flag really does is enable the counter action.

With the tank in a favorable position, the subtask sets the necessary flags, transfers variables, prints the initial launch from the aircraft, restores variables as needed and returns.

Keep Things in Motion

There is another necessity associated with setting things in motion. One must ensure the motion will continue as intended while the program marches on—the bombs we just dropped, for instance. The planes continue on across the screen while the bombs begin their descent. Then, a few seconds later, the tank commander shoots down one of the planes. As a solution, I ended up with a horren-



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dous number of flags and what I might describe as transition variables: temporaries. These are each set in accordance with a given condition, then reset or modified when the condition changes.

In the beginning, I made an attempt to link the variable to its function, using TP for tank position, TG for tank gun, etc. After a while I found myself swamped and had to change my tactics. So I can tell you that BH is bomber hit, and FH fighter hit—if the value = 0, it is alive and airborne; if the value = 1, then it has been shot down. On the other hand, most of the Bs, Gs, Hs, Rs and Ss are set up to define parallel happenings. (We'll have more on this later when we loop back for a look at the flags we raced through at the beginning.)

I hope you follow along with the listing as we progress. Observe, for instance, that when a bomb cluster is dropped, the FA flag is set = 0 while a new flag, GA, picks up its value.

The next task in the flowchart is labeled Keyboard/Pad Inputs. Four cursor keys are located on a pad to the right of the H89's keyboard. The "4" and "6" keys sport left and right arrows, respectively. With these two keys you run the tank from side to side. You'll want to keep the first and third fingers of your right hand on these; your left hand should rest on the left side of the keyboard—little finger on the "A," index finger on "F," and thumb on the space bar. This way you'll be in position to lob a shell straight up with a flick of your thumb, or at one of the four angles available

B$ = CHR$(7)	Ring the console bell
BD$ = CHR$(107)	Down arrow graphic
M$ = C$ + C$	Cursor right two places
N$ = C$ + C$ + C$	Cursor right three places
O$ = C$ + C$ + C$ + C$	Cursor right four places
R$ = C$ + C$ + C$ + C$ + C$	Cursor right five places
S$ = C$ + C$ + C$ + C$ + C$ + C$	Cursor right six places
T$ = C$ + C$ + C$ + C$ + C$ + C$ + C$	Cursor right seven places
V$ = C$ + C$ + C$ + C$ + C$ + C$ + C$ + C$	Cursor right eight places
SP$ = CHR$(32)	Print one space
U$ = CHR$(95)	Triangle graphic *
UA$ = CHR$(94)	Oval graphic (tank shell)

* Used with reverse video for bomber wing. See 5000.

Table 2. Listing of string functions employed in Tank Commander and their definitions.

TP	Tank Position. Initially at column 47.
TG	Tank Gun. TP + 2. Exit for tank shell.
AMM	Ammunition remaining. Initial issue = 80.
TNK	Tank number displayed on graphic.
TK	Tanks remaining. Initial issue is 3.
SCR	Players score. = 100 for each plane shot down.
AA, AB, AC	Flags set for shell in air. 3 shells at any one time is the limit.
VA0, VA1, VA2	Upper boundary for fired shell.
BH1, BH2, BH3	Flag set to 1 when bomber 1, 2, or 3 is hit.
FH1, FH2, FH3	Flag set to 1 when fighter 1, 2, or 3 is hit.
DC	The value of a counter incremented with each pass of the program loop. Increments to 20, then resets.
EC	Same function as DC for rocket firing. Initial value is 84. Decrements to 68, then resets to 84.
DZ, EZ	Flags initialized at first bomb drop, rocket firing in progress.
D1-D4	Flags set to maintain bomb drop in progress.
E1-E4	Flags set to maintain rocket firing in progress.
FA	The value of this variable is the formation cue used by the bomb drop routine.
FB	The value of this variable is the formation cue used by the rocket firing routine.

Table 3. Definitions of selected variables. There are too many flags employed to list them all, but the above will be helpful in obtaining a grasp of the program's functioning.

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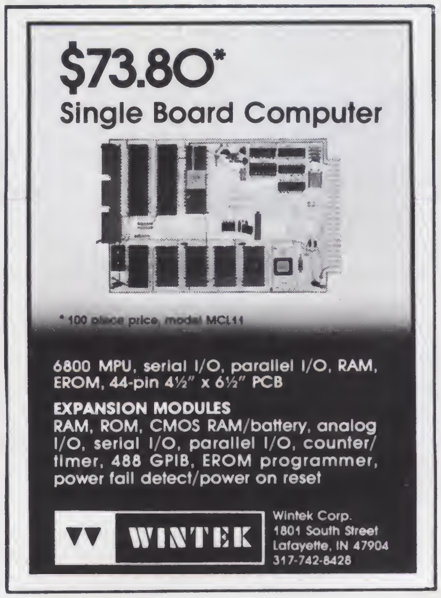
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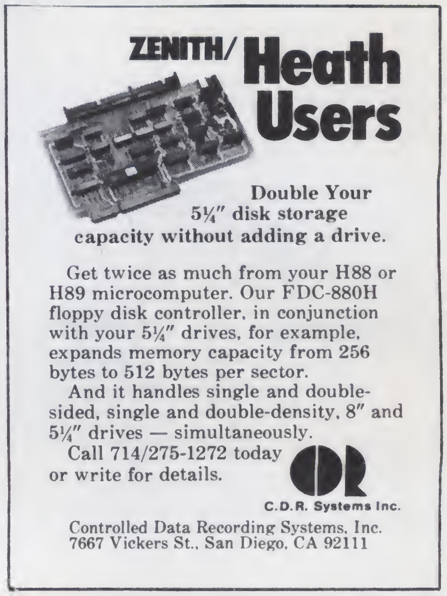
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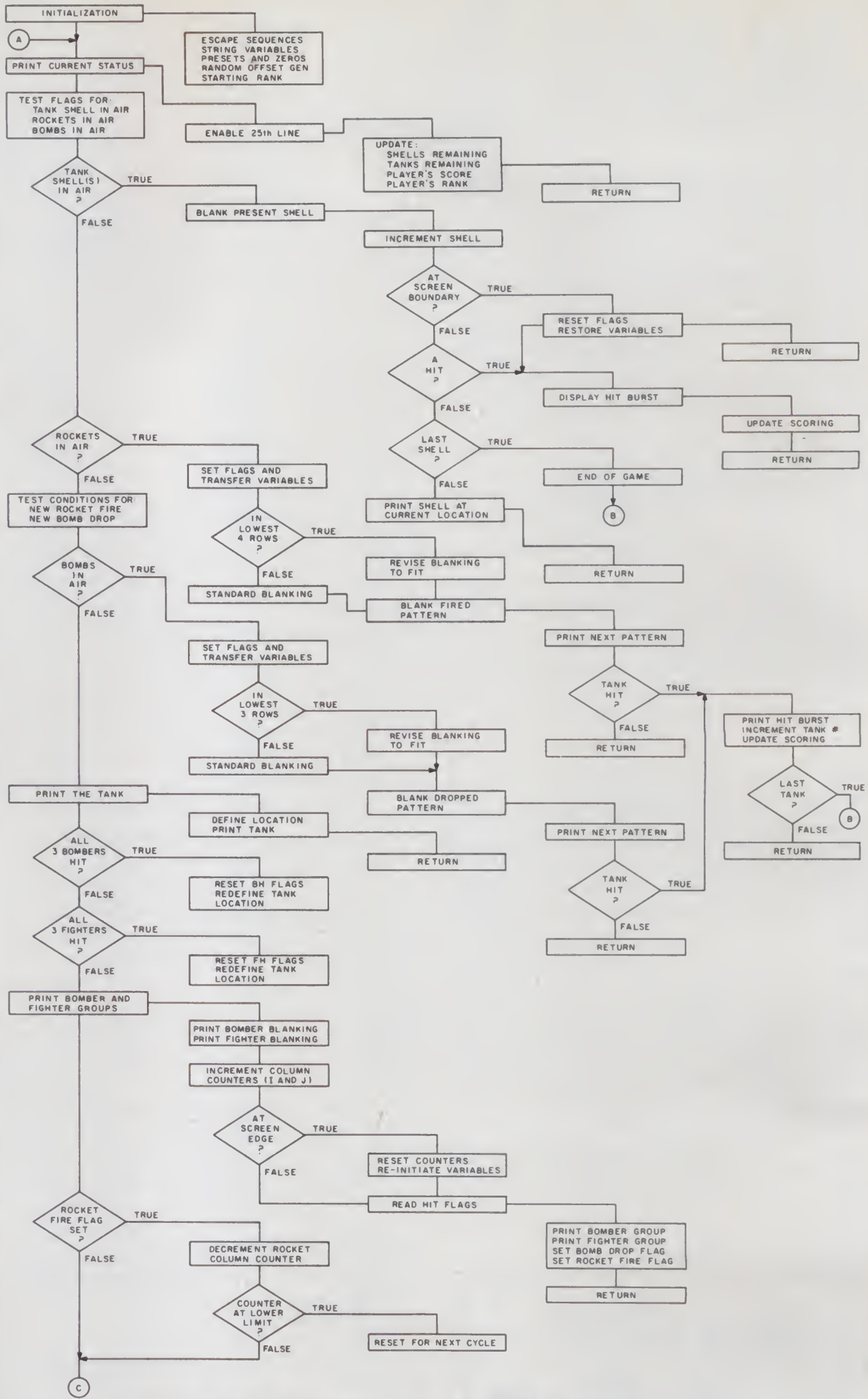

Fig 2. The program flowchart for Tank Commander.

with your fingers.

Should you wish to end the game before its natural conclusion, just type "Q." This quitting function was put in primarily as a time-saving convenience. Simply hitting control-C, as I did for a long time, leaves you in the graphics mode without a cursor on a frequently messy screen.

Moving the tank is just a matter of incrementing or decrementing the values of TP and TG. I could have written TP = TP + 3 and the tank would simply have reappeared three spaces to the right. Using the counter gives it a stepping mode, lending a touch that several people have commented on favorably.

If you can work your way through the gun-firing logic, you've got it made. The first firing will set flag AA, store the tank gun location in TG0, store the firing angle, S0, in two variables, S1 and SA (why two?), store the cursor move in ER0$ and direct the routine to 2330. Two more shells can be fired with a similar procedure. Further attempts to fire the gun will yield a return until one of the three flags is cleared.

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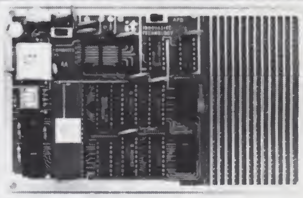

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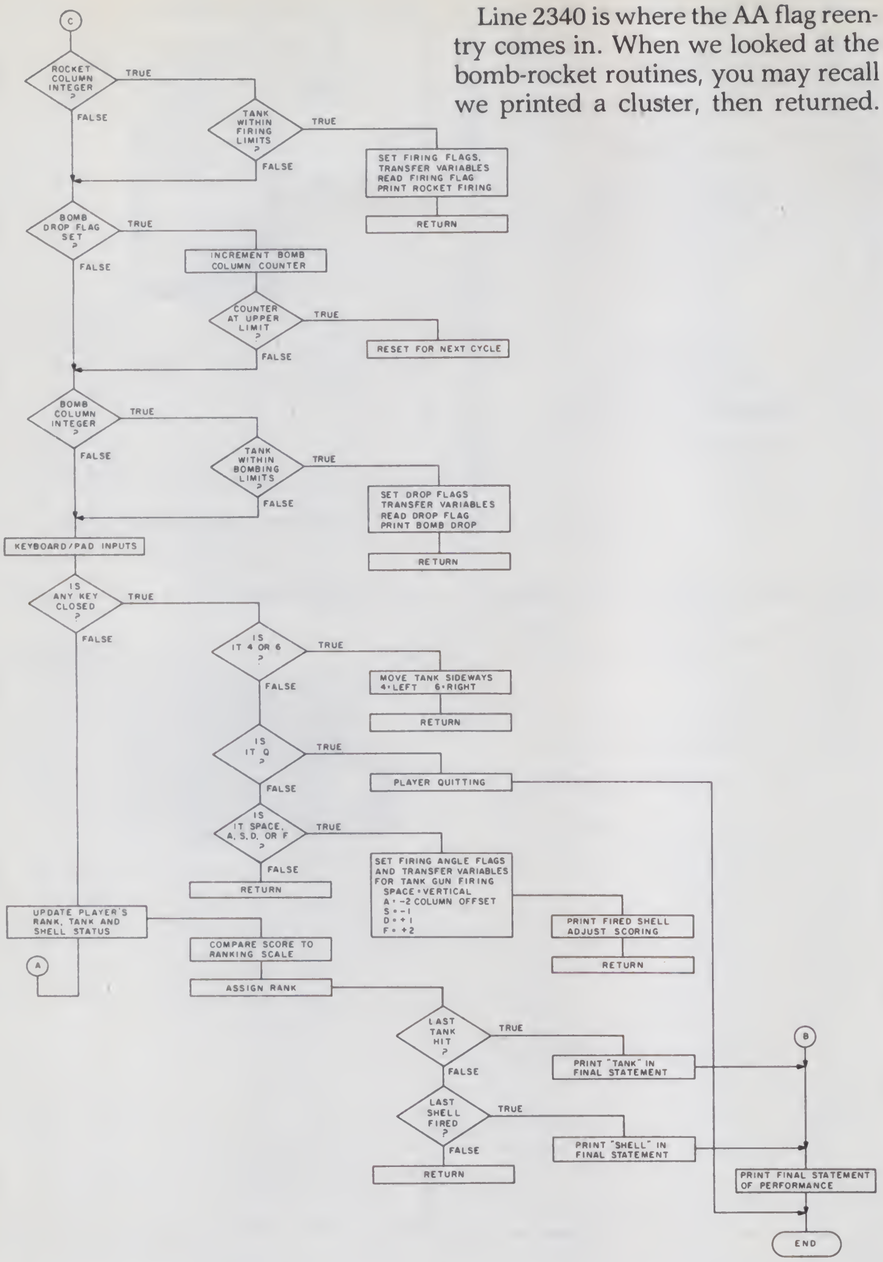
C
ROCKET COLUMN INTEGER ?
TRUE
FALSE
TANK WITHIN FIRING LIMITS ?
TRUE
FALSE
SET FIRING FLAGS, TRANSFER VARIABLES READ FIRING FLAG PRINT ROCKET FIRING
RETURN
BOMB DROP FLAG SET ?
TRUE
FALSE
INCREMENT BOMB COLUMN COUNTER
COUNTER AT UPPER LIMIT ?
TRUE
FALSE
RESET FOR NEXT CYCLE
BOMB COLUMN INTEGER ?
TRUE
FALSE
TANK WITHIN BOMBING LIMITS ?
TRUE
FALSE
SET DROP FLAGS TRANSFER VARIABLES READ DROP FLAG PRINT BOMB DROP
RETURN
KEYBOARD/PAD INPUTS
IS ANY KEY CLOSED ?
TRUE
FALSE
IS IT 4 OR 6 ?
TRUE
FALSE
MOVE TANK SIDEWAYS 4 = LEFT 6 = RIGHT
RETURN
IS IT Q ?
TRUE
FALSE
PLAYER QUITTING
IS IT SPACE, A, S, D, OR F ?
TRUE
FALSE
RETURN
SET FIRING ANGLE FLAGS AND TRANSFER VARIABLES FOR TANK GUN FIRING SPACE = VERTICAL A = -2 COLUMN OFFSET S = -1 D = +1 F = +2
PRINT FIRED SHELL ADJUST SCORING
RETURN
UPDATE PLAYER'S RANK, TANK AND SHELL STATUS
A
COMPARE SCORE TO RANKING SCALE
ASSIGN RANK
LAST TANK HIT ?
TRUE
FALSE
PRINT "TANK" IN FINAL STATEMENT
B
LAST SHELL FIRED ?
TRUE
FALSE
PRINT "SHELL" IN FINAL STATEMENT
RETURN
PRINT FINAL STATEMENT OF PERFORMANCE
END

Fig. 2 (continued). The main program looping is displayed in the left column, with subroutine activity moving off toward the right.

Line 2340 is where the AA flag reentry comes in. When we looked at the bomb-rocket routines, you may recall we printed a cluster, then returned. On the subtask reentry we are going to have to blank the cluster, advance the counter and print the next. The tank shell differs in that there is only one print routine. If I had neglected to mention this, it might have taken you longer to figure out why 2340 begins as it does.

The primary reason for 2330 (and the two that follow it) is to prepare for the print statement, 2360. 2360 draws a new shell, drops back to erase the previous firing and ends up by incrementing the row number in preparation for the next shot.

We just may be trying to fire the shell through one side of our screen. Should that turn out to be true, we set flag SE and overprint the shell with a space. We don't want to fire this shell again, so SE will be read a little later as a reset instruction. And since the program will not be this way again, the shell that was fired must be blanked now before leaving.

The gun fires from the tank's center, top row. It leaves a gaping hole unless something is done to fill it. What you do is redraw the tank; this is the reason for the If condition of statement 2370. Watch for it when you fire the gun.

It would be nice to know if we scored a hit, so after incrementing the necessary variables, we jump to 4010 to compare the coordinates stored in SR and SS with those of the aircraft. If no hit has occurred, the program returns. If a hit has occurred, a jump is made to update the scoring; another jump is made to replace the unlucky airplane with a shell burst; a return completes the transfer of variables and makes a return to the main program.

The final task is to update the player's rank and scoring before loop-

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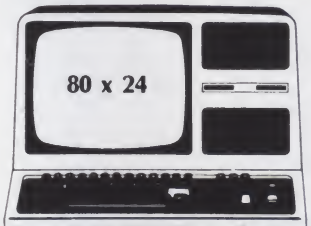

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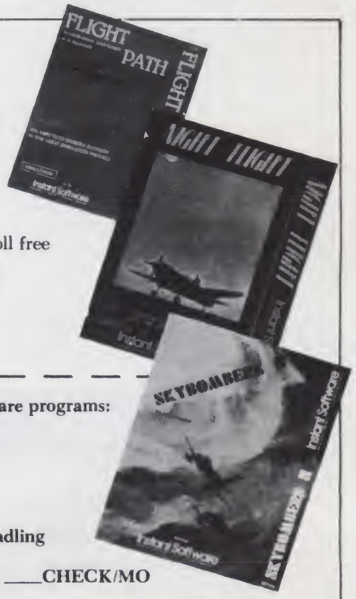

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ing back for its display.

The tank firing has been sufficiently described, I think, but the description of the rockets and/or bombs is another matter.

The objective is to keep up to four clusters of bombs and/or rockets in the air at a time, maintained in what might be described as a ring-around mode. That is the reason for resetting DC and EC to 0 when their value reaches 20 and 68, respectively. Two potential problem areas exist: one when the aircraft reaches the limits of screen travel and the counters reset, and the other when activity is suspended, because the tank is out of range, and is resumed later. When these two things occur together, there is an added possibility of trouble. I'll touch on this a little later.

The tank-shell program differs from the bomb and rocket in that the initial activity and that maintained by the set flag come together prior to the printing of the shell. In the bomb/rocket program, two independent sequences are used: the first to print the intitial drop/firing, the second for maintenance. Common variables are employed, of course, with the necessary transfers, but otherwise the sharing occurs only in the cluster printing.

As the rockets and bombs near the ground, the cluster has to be modified to cause a disappearance, one by one, of the "below-ground" components. If one of these gets into row 24, it causes an unwelcome line feed, one that I never did learn to outmaneuver.

Logic to detect a hit on the tank also had to be constructed, with an instruction to display the hit and to decrement the tank count if a hit has occurred. A lot of detail is involved here, more than I can go into now. I will point out that ZU, ZV and ZW in 1710, 1714 and 1718 are there to avoid suffering the loss of a tank from nonexistent rockets.

The scattered approach to scoring is confusing to follow. I added the scoring after just about everything else had been done, and it was a bit tricky to pull it all together in a consistent manner. At the end, while mulling over the presentation of the final report to the player, I tacked on the arithmetic for the hit factor.

Summary

I don't claim perfection for Tank Commander. It has its defects. A certain amount of litter, for example, lingers in the sky following airbursts occurring at an aircraft's trailing extremity. I depend on group blanking to sweep this up and sometimes a shard or two is missed.

From time to time you will see a piece of the tank, an aircraft or another object disappear for no apparent reason, then reappear on the next program loop. Again, a blanking effect arises because only a single blanking routine is employed, regardless of reduction in group number—i.e., even if only one aircraft remains, the blanking sweeps for the original three. This arises from the great increase in program that would be required to adjust the blanking for all the variations that are possible. I suspect this is true of the fast arcade games as well, except

Listing 1. The listing is not by numerical order, but in a sequence that you can follow more easily in the tracing through of the several functions carried out by the program. The flowchart and listing should be studied together.

```
1 REM ***************************** TANKCMDR *********************************
2 REM ********* A MICROSOFT BASIC VIDEO GAME FOR THE H89 WITH CP/M *********
3 REM ******************************** BY ************************************
4 REM **************************** C.S.PEPPER ********************************
5 REM ***************************               ******************************
6 REM ************************************************************************
7 REM:
8 DEFINT A-Z
9 REM *** HEATH ESCAPE SEQUENCES ***
10 A$=CHR$(27)+"A
11 B$=CHR$(27)+"B
12 C$=CHR$(27)+"C
13 D$=CHR$(27)+"D
14 E$=CHR$(27)+"E
15 F$=CHR$(27)+"F
16 G$=CHR$(27)+"G
17 H$=CHR$(27)+"H
18 J$=CHR$(27)+"j
19 K$=CHR$(27)+"k
20 KL$=CHR$(27)+"K
21 P$=CHR$(27)+"p
22 Q$=CHR$(27)+"q
23 X1$=CHR$(27)+"x1
```

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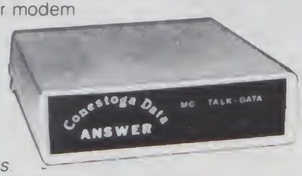

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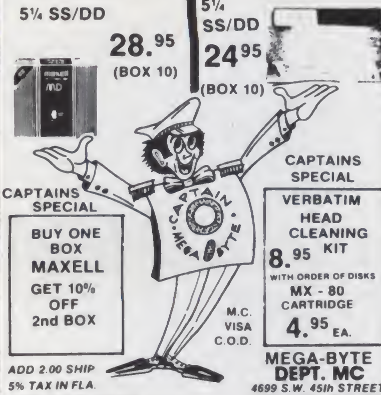

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Listing continued.

```
24 X5$=CHR$(27)+"x5
25 Y$=CHR$(27)+"Y
26 Y1$=CHR$(27)+"y1
27 Y5$=CHR$(27)+"y5
29 REM *** STRING VARIABLES ***
30 B7$=CHR$(7)
31 BD$=CHR$(107)
32 M$=C$+C$
33 N$=C$+C$+C$
34 O$=C$+C$+C$+C$
35 R$=C$+C$+C$+C$+C$
36 S$=C$+C$+C$+C$+C$+C$
37 T$=C$+C$+C$+C$+C$+C$+C$
38 V$=C$+C$+C$+C$+C$+C$+C$+C$
39 SP$=CHR$(32)
40 U$=CHR$(95)
41 UA$=CHR$(94)
55 REM *** INITIALIZE ***
60 TP=47:TG=TP+2:AMM=80:TNK=1:TK=3:SCR=0
61 AA=0:AB=0:AC=0:S4=0:S5=0:S6=0:SE=0:VA0=20:VA1=20:VA2=20
62 I=0:J=0:BH1=0:BH2=0:BH3=0:FH1=0:FH2=0:FH3=0
63 DC=0:D1=0:D2=0:D3=0:D4=0:FA=0:GW=0:GX=0:GY=0:GZ=0:RV=0:RW=0:RX=0:RY=0:RZ=0
64 EC=84:E1=0:E2=0:E3=0:E4=0:EZ=0:FB=0:HW=0:HX=0:HY=0:HZ=0:RC=0:RD=0:RE=0:RF=0:R
R=0
94 REM:
95 REM *** PROGRAM ***
96 REM:
100 PRINT E$;X5$;F$
101 RANDOMIZE PEEK(11):BR=INT(RND*4)
102 BA=BR+32:BB=BR+33:RA=98-BR:RB=95-BR
103 GOSUB 400
105 PRINT X1$;Y$;CHR$(56);CHR$(32);KL$;O$;J$:GOSUB 2220
110 IF AA=1 THEN GOSUB 2340
111 IF AB=1 THEN GOSUB 2344
112 IF AC=1 THEN GOSUB 2348
115 IF E1=1 THEN GOSUB 1660
116 IF E2=1 THEN GOSUB 1662
117 IF E3=1 THEN GOSUB 1664
118 IF E4=1 THEN GOSUB 1666
130 IF D1=1 THEN GOSUB 1432
131 IF D2=1 THEN GOSUB 1434
132 IF D3=1 THEN GOSUB 1436
133 IF D4=1 THEN GOSUB 1438
150 GOSUB 500
154 IF BH1=1 AND BH2=1 AND BH3=1 THEN BH1=0:BH2=0:BH3=0:GOSUB 600:TP=52:TG=TP+2
156 IF FH1=1 AND FH2=1 AND FH3=1 THEN FH1=0:FH2=0:FH3=0:GOSUB 600:TP=42:TG=TP+2
160 GOSUB 1000
170 IF EZ=1 THEN EC=EC-1:IF EC=68 THEN EC=84
175 IF (EC-4)/4=INT((EC-4)/4) THEN IF 98-(J+BR)<=TP+45 AND 98-(J+BR)>=TP+20 THEN
   EZ=1:GOSUB 1610
184 IF DZ=1 THEN DC=DC+1:IF DC=20 THEN DC=0
185 IF (DC+5)/5=INT((DC+5)/5) THEN IF BA+I>=TP-13 AND BA+I<TP+12 THEN DZ=1:GOSUB
 1410
200 IN$=INKEY$:IF IN$<>"" THEN  GOSUB 2300
240 GOSUB 400
250 GOTO 105
280 PRINT Y1$;H$;Y5$;G$:IF SCR=8000 THEN 330
290 IF IN$="Q" THEN PRINT E$:GOTO 350
300 GOSUB 400:PRINT E$:PRINT Y$;CHR$(34);CHR$(36);"SORRY ";TI$;", THAT WAS YOUR
LAST ";TH$;".  YOUR SCORE IS";SCR:PRINT "    YOU GOT OFF ";80-AMM;"ROUNDS FOR A
HIT FACTOR OF ";(SCR*.01)/(80-AMM):GOTO 350
330 PRINT E$;Y$;CHR$(34);CHR$(36);P$;" EXCELLENT SHOW, GENERAL ";Q$
350 END
400 IF SCR<=600 THEN TI$="CORPORAL":GOTO 470
410 IF SCR<=1200 THEN TI$="SARGE":GOTO 470
420 IF SCR<=2400 THEN TI$="LIEUTENANT":GOTO 470
430 IF SCR<=5000 THEN TI$="CAPTAIN":GOTO 470
440 IF SCR<=7000 THEN TI$="MAJOR":GOTO 470
450 IF SCR<=7900 THEN TI$="COLONEL":GOTO 470
470 IF TK=0 THEN TH$="TANK":RETURN
480 IF AMM=-1 THEN TH$="SHELL":RETURN


2220 PRINT K$;"YOU HAVE";AMM;"SHELLS AND";TK;"TANKS.        YOUR SCORE IS NOW";S
CR;TI$:IF TK=0 OR AMM=-1 THEN 280 ELSE RETURN


500 PRINT Y$;CHR$(52);CHR$(TP);J$:GOSUB 2000:RETURN
600 PRINT Y$;CHR$(52);CHR$(TP);J$:GOSUB 2100:RETURN
700 PRINT Y$;CHR$(52);CHR$(TP);J$:GOSUB 2200:RETURN


2000 PRINT K$;"c";P$;"r";Q$;"i";P$;U$;Q$;"f";K$;B$;"i";TNK;"i":RETURN
2100 PRINT K$;"     ";K$;B$;"     ":RETURN
2200 PRINT G$; K$;" \!!/ ";K$;B$;"  **  ";B7$;B7$;F$:RETURN


1000 PRINT Y$;CHR$(34);CHR$(BA+I);J$:GOSUB 5100
1100 PRINT Y$;CHR$(39);CHR$(RA-J);J$:GOSUB 5300
1180 I=I+1:J=J+1
1185 IF I=<63 THEN 1200
1190 I=0:J=0:DC=0:EC=84
1200 PRINT Y$;CHR$(34);CHR$(BA+1);J$
1210 IF BH1=0 AND BH2=0 AND BH3=0 THEN FA=1:GOSUB 5000
1214 IF BH1=0 AND BH2=0 AND BH3=1 THEN FA=2:GOSUB 5600
1218 IF BH1=0 AND BH2=1 AND BH3=0 THEN FA=3:GOSUB 5500
1222 IF BH1=0 AND BH2=1 AND BH3=1 THEN FA=4:GOSUB 5800
1226 IF BH1=1 AND BH2=0 AND BH3=0 THEN FA=5:GOSUB 5400
1230 IF BH1=1 AND BH2=0 AND BH3=1 THEN FA=6:GOSUB 5900
1234 IF BH1=1 AND BH2=1 AND BH3=0 THEN FA=7:GOSUB 5700
```

More

with their speed, this is not easily observed.

Now and then an out-of-sync rocket burst occurs. This always seems to happen on the second, or later, screen pass, and I think, though I can't be positive, that there is an association with moving the tank. Typically, this foreign firing just hangs in the sky until swept out by the advancing fighters.

My purpose in writing this, as stated at the beginning, is to relate my experience in the design of a video action game. Hopefully, I have accomplished what I set out to do, which was to provide an insight into the kind of problems that exist and approaches that can be taken to find their solutions. I am sure that, as the saying goes, there are many ways to skin a cat, and this article presents only one. Writing the program was an invaluable learning exercise for me; through it I gained a familiarity with my terminal's capabilities. I also picked up a few tricks in Basic that will be useful in future endeavors.

So think up a game you'd like to write and give it a try. If it worked for me, it has to do the same for you.■

Listing continued.

```
1238 IF BH1=1 AND BH2=1 AND BH3=1 THEN FA=8:GOSUB 5100
1300 PRINT Y$;CHR$(39);CHR$(RA-J);J$
1310 IF FH1=0 AND FH2=0 AND FH3=0 THEN FB=1:GOSUB 5200
1314 IF FH1=0 AND FH2=0 AND FH3=1 THEN FB=2:GOSUB 6200
1318 IF FH1=0 AND FH2=1 AND FH3=0 THEN FB=3:GOSUB 6100
1322 IF FH1=0 AND FH2=1 AND FH3=1 THEN FB=4:GOSUB 6400
1326 IF FH1=1 AND FH2=0 AND FH3=0 THEN FB=5:GOSUB 6000
1330 IF FH1=1 AND FH2=0 AND FH3=1 THEN FB=6:GOSUB 6500
1334 IF FH1=1 AND FH2=1 AND FH3=0 THEN FB=7:GOSUB 6300
1338 IF FH1=1 AND FH2=1 AND FH3=1 THEN FB=8:GOSUB 5300
1340 RETURN
4997 REM :
4998 REM ### BOMBER FULL FLIGHT ASSY ###
4999 REM :
5000 PRINT K$;"{1{";P$;U$;Q$;K$;B$;J$;"zozr";M$;"{1{";P$;U$;Q$;K$;B$;J$;M$;"{1{";P$;U$;Q$;"zozr";K$;B$;M$;"zozr":RETURN
5098 REM ### BLANK BOMBER FLIGHTS ###
5100 PRINT K$;"    ";K$;B$;J$;"    ";M$;"    ";K$;B$;J$;M$;"          ";K$;B$;M$;"    " : RETURN
5198 REM ### FIGHTER FULL FLIGHT ASSY ###
5200 PRINT K$;O$;"{b{1a";K$;B$;J$;O$;"zbzoa";K$;B$;J$;"{b{Ia";K$;B$;J$;"zbzoa";N$;"{b{Ia";K$;B$;J$;V$;"zbzoa";K$;B$;R$:RETURN
5298 REM ### BLANK FIGHTER FLIGHTS ###
5300 PRINT K$;O$;"     ";K$;B$;J$;O$;"     ";K$;B$;J$;"     ";K$;B$;J$;"     ";N$;"     ";K$;B$;J$;V$;"     ":RETURN
5398 REM ### BOMBER #1 HIT ###
5400 PRINT K$;"    ";K$;B$;J$;"    ";M$;"{I{";P$;U$;Q$;K$;B$;J$;M$;"{I{";P$;U$;Q$;"zozr";K$;B$;M$;"zozr":RETURN
5498 REM ### BOMBER #2 HIT ###
5500 PRINT K$;"{I{";P$;U$;Q$;K$;B$;J$;"zozr";M$;"    ";K$;B$;J$;M$;"{1{";P$;U$;Q$;"    ";K$;B$;M$;"zozr":RETURN
5598 REM ### BOMBER #3 HIT ###
5600 PRINT K$;"{1{";P$;U$;Q$;K$;B$;J$;"zozr";M$;"{1{";P$;U$;Q$;K$;B$;J$;C$;"    zozr";K$;B$;"     ":RETURN
5698 REM ### BOMBERS #1 AND #2 HIT ###
5700 PRINT K$;"     ";K$;B$;J$;"          ";K$;B$;J$;M$;"{1{";P$;U$;Q$;"    ";K$;B$;M$;"zozr":RETURN
5798 REM ### BOMBERS #2 AND #3 HIT ###
5800 PRINT K$;"{1{";P$;U$;Q$;K$;B$;J$;"zozr";M$;"    ";K$;B$;J$;"          ";K$;B$;"     ":RETURN
5898 REM ### BOMBERS #1 AND#3 HIT ###
5900 PRINT K$;"    ";K$;B$;J$;"    ";M$;"{1{";P$;U$;Q$;K$;B$;J$;C$;"    zozr";K$;B$;"     ":RETURN
5998 REM ### FIGHTER #1 HIT ###
6000 PRINT K$;O$;"     ";K$;B$;J$;O$;"     ";K$;B$;J$;"{b{Ia";K$;B$;J$;"zbzoa";N$;"{b{Ia";K$;B$;V$;"zbzoa":RETURN
6098 REM ### FIGHTER #2 HIT ###
6100 PRINT K$;O$;"{b{1a";K$;B$;J$;O$;"zbzoa";K$;B$;J$;"     ";K$;B$;J$;"     ";N$;"{b{Ia";K$;B$;V$;"zbzoa":RETURN
6198 REM ### FIGHTER #3 HIT ###
6200 PRINT K$;O$;"{b{Ia";K$;B$;J$;O$;"zbzoa";K$;B$;J$;"{b{1a";K$;B$;J$;"zbzoa";M$;"     ";K$;B$;V$;"     ":RETURN
6298 REM ### FIGHTERS #1 AND #2 HIT ###
6300 PRINT K$;O$;"     ";K$;B$;J$;O$;"     ";K$;B$;J$;"          ";K$;B$;J$;"     ";N$;"{b{Ia";K$;B$;V$;"zbzoa":RETURN
6398 REM ### FIGHTERS #2 AND #3 HIT ###
6400 PRINT K$;O$;"{b{1a";K$;B$;J$;O$;"zbzoa";K$;B$;J$;"     ";K$;B$;J$;"     ";M$;"     ";K$;B$;T$;"     ":RETURN
6498 REM ### FIGHTERS #1 AND #3 HIT ###
6500 PRINT K$;"          ";K$;B$;J$;O$;"     ";K$;B$;J$;"{b{1a";K$;B$;J$;"zbzoa";M$;"     ";K$;B$;V$;"     ":RETURN
```

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Listing continued.

```
1403 REM:
1404 REM $$$ BOMB DROP $$$
1405 REM:
1410 PRINT Y$;CHR$(36);CHR$(BB+I);J$:GOSUB 1430
1411 DD=INT((DC+5)/5)
1412 IF DD=1 THEN IF D1=0 THEN 1420
1413 IF DD=2 THEN IF D2=0 THEN 1421
1414 IF DD=3 THEN IF D3=0 THEN 1422
1415 IF DD=4 THEN IF D4=0 THEN 1423
1416 RETURN
1420 D1=1:GJ=GA:BC=BB+1:BJ1=BH1:BJ2=BH2:BJ3=BH3:GOTO 1425
1421 D2=1:GK=GA:BD=BB+I:BK1=BH1:BK2=BH2:BK3=BH3:GOTO 1425
1422 D3=1:GP=GA:BE=BB+1:BP1=BH1:BP2=BH2:BP3=BH3:GOTO 1425
1423 D4=1:GM=GA:BF=BB+1:BM1=BH1:BM2=BH2:BM3=BH3:GOTO 1425
1425 GA=0:RETURN
1430 IF FA=1 THEN 7810 ELSE IF FA=2 THEN 7840 ELSE IF FA=3 THEN 7830 ELSE IF FA=
4 THEN 7860 ELSE IF FA=5 THEN 7820 ELSE IF FA=6 THEN 7870 ELSE IF FA=7 THEN 7850
 ELSE IF FA=8 THEN 7880 ELSE IF FA=9 THEN 7890
1432 D9=6:ZZ=BJ1:ZY=BJ2:ZX=BJ3:GN=GJ:BZ=BC:RZ=RV+36:GOSUB 1470:RV=RV+1:GOTO 1425
1434 D9=7:ZZ=BK1:ZY=BK2:ZX=BK3:GN=GK:BZ=BD:RZ=RY+36:GOSUB 1470:RY=RY+1:GOTO 1425
1436 D9=8:ZZ=BP1:ZY=BP2:ZX=BP3:GN=GP:BZ=BE:RZ=RX+36:GOSUB 1470:RX=RX+1:GOTO 1425
1438 D9=9:ZZ=BM1:ZY=BM2:ZX=BM3:GN=GM:BZ=BF:RZ=RW+36:GOSUB 1470:RW=RW+1:GOTO 1425
1470 IF RZ=52 THEN GN=8:GOTO 1480
1472 IF RZ=51 AND ZZ=0 THEN GN=4 ELSE IF RZ=51 AND ZZ=1 THEN GN=9:GOTO 1480
1474 IF RZ=50 AND ZZ=0 AND ZY=0 THEN GN=2 ELSE IF RZ=50 AND ZZ=1 AND ZY=0 THEN G
N=6 ELSE IF RZ=50 AND ZZ=0 AND ZY=1 THEN GN=4
1480 PRINT Y$;CHR$(RZ-1);CHR$(BZ);J$:GOSUB 7880:FA=GN
1481 PRINT Y$;CHR$(RZ);CHR$(BZ);J$:GOSUB 1430
1485 IF RZ=>50 AND RZ=<52 THEN 1486 ELSE RETURN
1486 IF RZ=52 THEN IF D9=6 THEN D1=0 ELSE IF D9=7 THEN D2=0 ELSE IF D9=8 THEN D3
=0 ELSE IF D9=9 THEN D4=0
1487 IF ZX=0 THEN IF RZ=50 THEN IF BZ+2>=TP AND BZ+2=<TP+4 THEN 1510
1490 IF ZY=0 THEN IF RZ=51 THEN IF BZ+6>=TP AND BZ+6=<TP+4 THEN 1510
1493 IF ZZ=0 THEN IF RZ=52 THEN IF BZ>=TP AND BZ=<TP+4 THEN  1510
1494 GOTO 1515
1510 TNK=TNK+1:GOSUB 4060:PRINT Y$;CHR$(52);CHR$(TP);J$:GOSUB 2200
1515 IF D1=0 THEN RV=0
1516 IF D2=0 THEN RY=0
1517 IF D3=0 THEN RX=0
1518 IF D4=0 THEN RW=0
1520 RETURN


7805 REM $$$ BOMBS $$$
7810 GA=1:FA=0:PRINT K$;"k";K$;B$;J$;S$;"k";K$;B$;M$;"k":RETURN
7815 REM $$$ BOMBS 2 AND 3 $$$
7820 GA=5:FA=0:PRINT K$;B$;J$;S$;"k";K$;B$;M$;"k":RETURN
7825 REM $$$ BOMBS 1 AND 3 $$$
7830 GA=3:FA=0:PRINT K$;"k";K$;B$;B$;M$;"k":RETURN
7835 REM $$$ BOMBS 1 AND 2 $$$
7840 GA=2:FA=0:PRINT K$;"k";K$;B$;S$;"k":RETURN
7845 REM $$$ BOMB 3 $$$
7850 GA=7:FA=0:PRINT K$;B$;B$;M$;"k":RETURN
7855 REM $$$ BOMB 1 $$$
7860 GA=4:FA=0:PRINT K$;"k";:RETURN
7865 REM $$$ BOMB 2 $$$
7870 GA=6:FA=0:PRINT K$;B$;S$;"k";:RETURN
7875 REM $$$ BLANK BOMBS $$$
7880 FA=0:PRINT K$;" ";K$;B$;J$;S$;" ";K$;B$;M$;" ":RETURN
7885 REM $$$ BLANK BOMB 1 $$$
7890 FA=0: PRINT K$;" ":RETURN


1604 REM:
1605 REM $$$ ROCKET FIRING $$$
1606 REM:
1610 PRINT Y$;CHR$(40);CHR$(RB-J);J$:GOSUB 1650
1612 EE=INT((EC-4)/4)
1620 IF EE=20 THEN IF HZ=0 THEN 1630
1621 IF EE=19 THEN IF HY=0 THEN 1632
1622 IF EE=18 THEN IF HX=0 THEN 1634
1624 IF EE=17 THEN IF HW=0 THEN 1636
1626 RETURN
1630 HZ=1:HJ=GB:E1=1:RC=RB-J:FJ1=FH1:FJ2=FH2:FJ3=FH3:GOTO 1640
1632 HY=1:HK=GB:E2=1:RD=RB-J:FK1=FH1:FK2=FH2:FK3=FH3:GOTO 1640
1634 HX=1:HL=GB:E3=1:RE=RB-J:FL1=FH1:FL2=FH2:FL3=FH3:GOTO 1640
1636 HW=1:HM=GB:E4=1:RF=RB-J:FM1=FH1:FM2=FH2:FM3=FH3:GOTO 1640
1640 GB=0:RETURN
1650 IF FB=1 THEN B810 ELSE IF FB=2 THEN 8840 ELSE IF FB=3 THEN 8830 ELSE IF FB=
4 THEN 8860 ELSE IF FB=5 THEN 8820 ELSE IF FB=6 THEN 8870 ELSE IF FB=7 THEN 8850
: ELSE IF FB=B THEN 8880 ELSE IF FB=9 THEN 8890
1660 E9=6:ZW=FJ1:ZV=FJ2:ZU=FJ3:HN=HJ:BY=RC:RR=RG+40:GOSUB 1670:RG=RG+1:RC=RC-3:G
OTO 1640
1662 E9=7:ZW=FK1:ZV=FK2:ZU=FK3:HN=HK:BY=RD:RR=RH+40:GOSUB 1670:RH=RH+1:RD=RD-3:G
OTO 1640
1664 E9=8:ZW=FL1:ZV=FL2:ZU=FL3:HN=HL:BY=RE:RR=RI+40:GOSUB 1670:RI=RI+1:RE=RE-3:G
OTO 1640
1666 E9=9:ZW=FM1:ZV=FM2:ZU=FM3:HN=HM:BY=RF:RR=RJ+40:GOSUB 1670:RJ=RJ+1:RF=RF-3:G
OTO 1640
1670 IF RR=52 THEN HN=9:FB=HN:GOTO 1686
```

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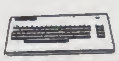

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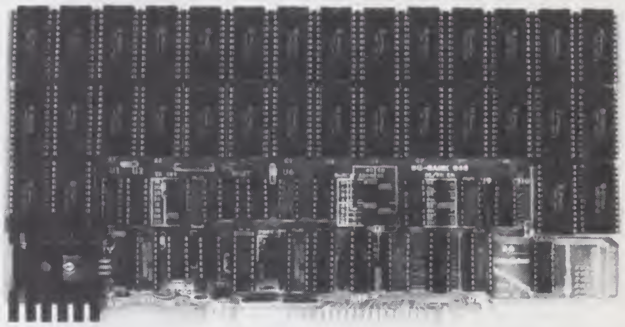

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Digital Research Computers	NO	NO	NO	NO
Compupro	NO	✓	NO	NO
SSM	NO	NO	NO	NO
Morrow	NO	NO	NO	NO
Omniram	NO	✓	NO	NO
MATCO	NO	NO	✓	NO
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Listing continued.

```
1671 IF RR=51 AND ZW=0 THEN HN=4 ELSE IF RR=51 AND ZN=1 THEN HN=9:GOTO 1684
1672 IF RR=50 AND ZW=0 THEN HN=4 ELSE IF RR=50 AND ZN=1 THEN HN=9:GOTO 1684
1674 IF RR=49 AND ZW=0 AND ZV=0 THEN HN=2 ELSE IF RR=49 AND ZW=1 AND ZV=0 THEN H
N=6 ELSE IF RR=49 AND ZN=0 AND ZV=1 THEN HN=4
1684 PRINT Y$;CHR$(RR);CHR$(BY);J$:GOSUB 8880:FB=HN
1686 PRINT Y$;CHR$(RR+1);CHR$(BY-3);J$:GOSUB 1650
1688 IF RR=51 THEN PRINT Y$;CHR$(52);CHR$(BY);C$;" "
1690 IF RR>=48 AND RR<=51 THEN 1700 ELSE RETURN
1700 IF RR=51 THEN IF E9=6 THEN E1=0 ELSE IF E9=7 THEN E2=0 ELSE IF E9=8 THEN E3
=0 ELSE IF E9=9 THEN E4=0
1710 IF ZU=0 THEN IF RR=48 THEN IF BY+5=>TP AND BY+5=<TP+5 THEN 1730
1714 IF ZV=0 THEN IF RR=49 THEN IF BY-3=>TP AND BY-3=<TP+5 THEN 1730
1718 IF ZW=0 THEN IF RR=51 THEN IF BY+1=>TP AND BY+1=<TP+5 THEN 1730
1720 GOTO 1740
1730 TNK=TNK+1:GOSUB 4060:PRINT Y$;CHR$(52);CHR$(TP);J$:GOSUB 2200
1740 IF E1=0 THEN HZ=0:RG=0:RC=0
1742 IF E2=0 THEN HY=0:RH=0:RD=0
1744 IF E3=0 THEN HX=0:RI=0:RE=0
1746 IF E4=0 THEN HW=0:RJ=0:RF=0
1750 RETURN
8805 REM ### ROCKETS ###
8810 GB=1:FB=0:PRINT K$;O$;"x";K$;B$;B$;J$;"x";K$;B$;V$;"x":RETURN
8815 REM ### ROCKETS 2 AND 3 ###
8820 GB=5:FB=0:PRINT K$;B$;B$;"x";K$;B$;V$;"x":RETURN
8825 REM ### ROCKETS 1 AND 3 ###
8830 GB=3:FB=0:PRINT K$;O$;"x";K$;B$;B$;B$;V$;"x":RETURN
8835 REM ### ROCKETS 1 AND 2 ###
8840 GB=2:FB=0:PRINT K$;O$;"x";K$;B$;B$;"x":RETURN
8845 REM ### ROCKET 3 ###
8850 GB=7:FB=0:PRINT K$;B$;B$;B$;V$;"x":RETURN
8855 REM ### ROCKET 1 ###
8860 GB=4:FB=0:PRINT K$;O$;"x":RETURN
8865 REM ### ROCKET 2 ###
8870 GB=6:FB=0:PRINT K$;B$;B$;"x":RETURN
8875 REM ### BLANK ROCKETS ###
8880 FB=0:PRINT K$;O$;" ";K$;B$;B$;J$;" ";K$;B$;V$;" ":RETURN
8885 REM ### BLANK ROCKET 1 ###
8890 FB=0:PRINT K$;O$;"  ":RETURN


2297 REM:
2298 REM ### KEYBOARD INPUTS : TANK POSITIONING, GUN FIRING ###
2299 REM:
2300 IF IN$="6" THEN GOSUB 3010 : RETURN
2310 IF IN$="4" THEN GOSUB 3030 : RETURN
2312 IF IN$="Q" THEN 280
2314 IF IN$=" " THEN SO=0:ER$="":GOTO 2320
2315 IF IN$="A" THEN SO=-2:ER$=C$+C$:GOTO 2320
2316 IF IN$="S" THEN SO=-1:ER$=C$:GOTO 2320
2317 IF IN$="D" THEN SO=1:ER$=D$:GOTO 2320
2318 IF IN$="F" THEN SO=2:ER$=D$+D$:GOTO 2320
2319 RETURN
2320 IF AA=0 THEN AA=1:TG0=TG:S1=S0:SA=S0:ER0$=ER$:GOTO 2330
2324 IF AB=0 THEN AB=1:TG1=TG:S2=S0:SB=S0:ER1$=ER$:GOTO 2334
2328 IF AC=0 THEN AC=1:TG2=TG:S3=S0:SC=S0:ER2$=ER$:GOTO 2338
2329 RETURN
2330 AMM=AMM-1:PRINT X1$;Y$;CHR$(56);CHR$(36);J$:GOSUB 2220:GOTO 2340
2334 AMM=AMM-1:PRINT X1$;Y$;CHR$(56);CHR$(36);J$:GOSUB 2220:GOTO 2344
2338 AMM=AMM-1:PRINT X1$;Y$;CHR$(56);CHR$(36);J$:GOSUB 2220:GOTO 2348
2340 ER$=ER0$:VA=VA0:HA0=S1:HA=HA0:GL=TG0:S4=1:GOTO 2360
2344 ER$=ER1$:VA=VA1:HA1=S2:HA=HA1:GL=TG1:S5=1:GOTO 2360
2348 ER$=ER2$:VA=VA2:HA2=S3:HA=HA2:GL=TG2:S6=1:GOTO 2360
2360 PRINT Y$;CHR$(31+VA);CHR$(GL+HA);J$;UA$;K$;B$;ER$;SP$:VA=VA-1
2362 IF VA=1 OR (GL+HA-1)<33 OR (GL+HA+1)>110 THEN SE=1:PRINT K$;" ":GOTO 2390
2370 IF VA=19 THEN GOSUB 500:GOTO 2390
2378 SR=31+VA:SS=GL+HA:GOSUB 4010
2390 IF S4=1 THEN 2400
2391 IF S5=1 THEN 2410
2392 IF S6=1 THEN 2420
2400 S4=0:VA0=VA:S1=S1+SA:TG0=GL:IF SE=1 THEN AA=0:VA0=20
2402 SE=0:RETURN
2410 S5=0:VA1=VA:S2=S2+SB:TG1=GL:IF SE=1 THEN AB=0:VA1=20
2412 SE=0:RETURN
2420 S6=0:VA2=VA:S3=S3+SC:TG2=GL:IF SE=1 THEN AC=0:VA2=20
2422 SE=0:RETURN


3000 REM ### MOVE TANK THREE SPACES TO THE RIGHT. ###
3010 FOR N=1 TO 3:GOSUB 600:TP=TP+1:GOSUB 500:NEXT N:TG=TG+3: RETURN
3020 REM ### MOVE TANK FIVE SPACES TO THE LEFT. ###
3030 FOR N=1 TO 5:GOSUB 600:TP=TP-1:GOSUB 500:NEXT N:TG=TG-5:RETURN


4010 IF BH1<>1 THEN IF SR=34 THEN IF SS=>1+BB-1 AND SS<=1+BB+3 THEN GOSUB 4040:S
E=1:BH1=1:RETURN
4014 IF BH2<>1 THEN IF SR=35 THEN IF SS=>1+BB+4 AND SS<=1+BB+8 THEN GOSUB 4040:S
E=1:BH2=1:RETURN
4018 IF BH3<>1 THEN IF SR=36 THEN IF SS=>1+BB+1 AND SS<=1+BB+5 THEN GOSUB 4040:S
E=1:BH3=1:RETURN
4020 IF FH3<>1 THEN IF SR=42 THEN IF SS=>RA+8-J AND SS=<RA+12-J THEN GOSUB 4040:
SE=1:FH3=1:RETURN
4024 IF FH2<>1 THEN IF SR=41 THEN IF SS=>RA-2-J AND SS=<RA+4-J THEN GOSUB 4040:S
E=1:FH2=1:RETURN
4028 IF FH1<>1 THEN IF SR=39 THEN IF SS=>RA+4-J AND SS=<RA+8-J THEN GOSUB 4040:S
E=1:FH1=1:RETURN
4034 RETURN
4040 SCR=SCR+100:PRINT Y$;CHR$(56);CHR$(36);J$:GOSUB 2220:PRINT Y$;CHR$(SR);CHR$
(SS-1);J$:GOSUB 2200:RETURN
4060 TK=TK-1:PRINT Y$;CHR$(56);CHR$(36);J$:GOSUB 2220:RETURN
```

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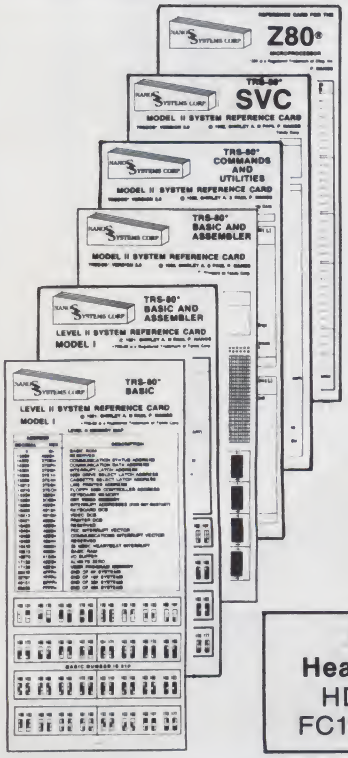

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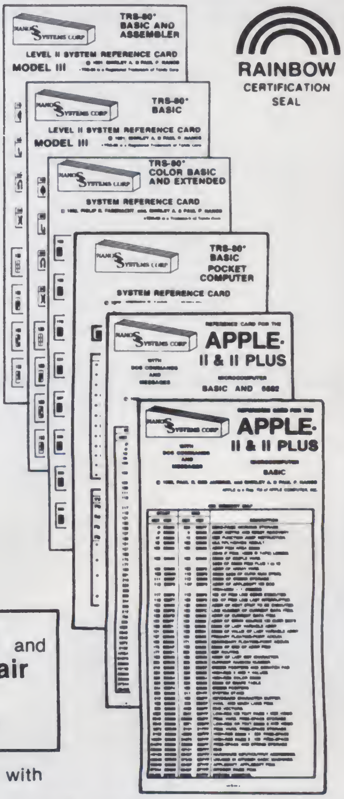

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3.579535	3.95
4.0	3.95
5.0	3.95
5.0688	3.95
5.185	3.95
5.7143	3.95
6.0	3.95
6.144	3.95
6.5536	3.95
8.0	3.95
10.0	3.95
10.738635	3.95
14.31818	3.95
15.0	3.95
16.0	3.95
17.430	3.95
18.0	3.95
18.432	3.95
20.0	3.95
22.1184	3.95
32.0	3.95

CRT CONTROLLERS

6845	14.95
68B45	19.95
HD46505SP	15.95
6847	11.95
MC1372	6.95
68047	24.95
8275	29.95
7220	99.95
CRT5027	39.95
CRT5037	49.95
TMS9918A	39.95
DP8350	49.95

KEYBOARD CHIPS

AY5-2376	11.95
AY5-3600	11.95

8000

8035	5.95
8039	6.95
INS-8060	17.95
INS-8073	24.95
8080	3.95
8085	5.95
8085A-2	11.95
8086	29.95
8087	CALL
8088	39.95
8089	89.95
8155	6.95
8155-2	7.95
8156	6.95
8185	29.95
8185-2	39.95
8741	39.95
8748	24.95
8755	24.95

8200

8202	24.95
8203	39.95
8205	3.50
8212	1.80
8214	3.85
8216	1.75
8224	2.25
8226	1.80
8228	3.49
8231	call
8237	19.95
8237-5	21.95
8238	4.49
8243	4.45
8250	10.95
8251	4.49
8253	6.95
8253-5	7.95
8255	4.49
8255-5	5.25
8257	7.95
8257-5	8.95
8259	6.90
8259-5	7.50
8271	39.95
8272	39.95
8275	29.95
8279	8.95
8279-5	10.00
8282	6.50
8283	6.50
8284	5.50
8286	6.50
8287	6.50
8288	25.00
8289	49.95

DISC CONTROLLERS

1771	16.95
1791	24.95
1793	26.95
1795	49.95
1797	49.95
2791	54.95
2793	54.95
2795	59.95
2797	59.95
6843	34.95
8272	39.95
UPD765	39.95
1691	17.95
2143	18.95

CONNECTORS

RS232 MALE	2.50
RS232 FEMALE	3.25
RS232 HOOD	1.25
S-100 ST	3.95

6800

68000	59.95
6800	3.95
6802	7.95
6808	13.90
6809E	19.95
6809	11.95
6810	2.95
6820	4.35
6821	3.25
6828	14.95
6840	12.95
6843	34.95
6844	25.95
6845	14.95
6847	11.95
6850	3.25
6852	5.75
6860	9.95
6862	11.95
6875	6.95
6880	2.25
6883	22.95
68047	24.95
68488	19.95

6800 = 1MHZ

68B00	10.95
68B02	22.25
68B09E	29.95
68B09	29.95
68B10	6.95
68B21	6.95
68B45	19.95
68B50	5.95

68B00 = 2 MHZ

6500

1 MHZ	
6502	4.95
6504	6.95
6505	8.95
6507	9.95
6520	4.35
6522	7.95
6532	9.95
6545	22.50
6551	11.85
2 MHZ	
6502A	6.95
6522A	9.95
6532A	11.95
6545A	27.95
6551A	11.95
3 MHZ	
6502B	14.95

UARTS

AY3-1014	6.95
AY5-1013	3.95
AY3-1015	6.95
PT1472	9.95
TR1602	3.95
2350	9.95
2651	8.95
TMS6011	5.95
IM6402	7.95
IM6403	8.95
INS8250	10.95

GENERATORS

BIT-RATE

MC14411	11.95
BR1941	11.95
4702	12.95
COM5016	16.95
COM8116	10.95
MM5307	10.95

FUNCTION

MC4024	3.95
LM566	1.49
XR2206	3.75
8038	3.95

74LS00

74LS00	.24	74LS173	
74LS01	.25	74LS174	
74LS02	.25	74LS175	
74LS03	.25	74LS181	2
74LS04	.24	74LS189	8
74LS05	.25	74LS190	
74LS08	.28	74LS191	
74LS09	.29	74LS192	
74LS10	.25	74LS193	
74LS11	.35	74LS194	
74LS12	.35	74LS195	
74LS13	.45	74LS196	
74LS14	.59	74LS197	
74LS15	.35	74LS221	
74LS20	.25	74LS240	
74LS21	.29	74LS241	
74LS22	.25	74LS242	
74LS26	.29	74LS243	
74LS27	.29	74LS244	
74LS28	.35	74LS245	1
74LS30	.25	74LS247	
74LS32	.29	74LS248	
74LS33	.55	74LS249	
74LS37	.35	74LS251	
74LS38	.35	74LS253	
74LS40	.25	74LS257	
74LS42	.49	74LS258	
74LS47	.75	74LS259	2
74LS48	.75	74LS260	
74LS49	.75	74LS266	
74LS51	.25	74LS273	1
74LS54	.29	74LS275	3
74LS55	.29	74LS279	
74LS63	1.25	74LS280	1
74LS73	.39	74LS283	
74LS74	.35	74LS290	
74LS75	.39	74LS293	
74LS76	.39	74LS295	
74LS78	.49	74LS298	
74LS83	.60	74LS299	1
74LS85	.69	74LS323	3
74LS86	.39	74LS324	1
74LS90	.55	74LS352	1
74LS91	.89	74LS353	1
74LS92	.55	74LS363	1
74LS93	.55	74LS364	1
74LS95	.75	74LS365	
74LS96	.89	74LS366	
74LS107	.39	74LS367	
74LS109	.39	74LS368	
74LS112	.39	74LS373	
74LS113	.39	74LS374	
74LS114	.39	74LS377	1
74LS122	.45	74LS378	1.
74LS123	.79	74LS379	1.
74LS124	2.90	74LS385	1
74LS125	.49	74LS386	
74LS126	.49	74LS390	1.
74LS132	.59	74LS393	1.
74LS133	.59	74LS395	1.
74LS136	.39	74LS399	1.
74LS137	.99	74LS424	2.
74LS138	.55	74LS447	
74LS139	.55	74LS490	1.
74LS145	1.20	74LS624	3.
74LS147	2.49	74LS640	2.
74LS148	1.35	74LS645	2.
74LS151	.55	74LS668	1.
74LS153	.55	74LS669	1.
74LS154	1.90	74LS670	1.
74LS155	.69	74LS674	9.
74LS156	.69	74LS682	3.
74LS157	.65	74LS683	3.
74LS158	.59	74LS684	3.
74LS160	.69	74LS685	3.
74LS161	.65	74LS688	2.
74LS162	.69	74LS689	3.
74LS163	.65	74LS783	24.
74LS164	.69	81LS95	1.
74LS165	.95	81LS96	1.
74LS166	1.95	81LS97	1.
74LS168	1.75	81LS98	1.
74LS169	1.75	25LS2521	2.
74LS170	1.49	25LS2569	4.

JDR Microdevices

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(408) 995-5430 • Telex 171-110

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TERMS: For shipping include $2 for UPS Ground or $3 for UPS
Label Air. Items over 5 pounds require additional shipping cha
Foreign orders, include sufficient amount for shipping. There is
minimum order. Bay Area and Los Angeles Counties add 6½% S
Tax. Other California residents add 6% Sales Tax. We reserve
right to substitute manufacturer. Not responsible for typograp
errors. Prices are subject to change without notice. We will mat
beat any competitor's price provided it is not below our cost.

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Circle 84 on Reader Service card.

2114 450 NS $8/\$9^{95}$ 2114 250 NS $8/\$10^{95}$

7400

0	.19	74132	.45
1	.19	74136	.50
2	.19	74141	.65
3	.19	74142	2.95
4	.19	74143	2.95
5	.25	74145	.60
6	.29	74147	1.75
7	.29	74148	1.20
8	.24	74150	1.35
9	.19	74151	.55
0	.19	74152	.65
1	.25	74153	.55
2	.30	74154	1.25
3	.35	74155	.75
4	.49	74156	.65
6	.25	74157	.55
7	.25	74159	1.65
0	.19	74160	.85
1	.35	74161	.69
2	.35	74162	.85
3	.29	74163	.69
5	.29	74164	.85
6	.29	74165	.85
7	.29	74166	1.00
8	.45	74167	2.95
0	.19	74170	1.65
2	.29	74172	5.95
3	.45	74173	.75
7	.29	74174	.89
8	.29	74175	.89
0	.19	74176	.89
2	.49	74177	.75
3	.65	74178	1.15
4	.69	74179	1.75
5	.69	74180	.75
6	.69	74181	2.25
7	.69	74182	.75
8	.69	74184	2.00
0	.19	74185	2.00
1	.23	74190	1.15
3	.23	74191	1.15
4	.23	74192	.79
0	.23	74193	.79
70	.35	74194	.85
72	.29	74195	.85
73	.34	74196	.79
74	.33	74197	.75
75	.45	74198	1.35
76	.35	74199	1.35
80	.59	74221	1.35
81	1.10	74246	1.35
82	.95	74247	1.25
83	.50	74248	1.85
85	.59	74249	1.95
86	.35	74251	.75
89	2.15	74259	2.25
90	.35	74265	1.35
91	.40	74273	1.95
92	.50	74276	1.25
93	.35	74279	.75
94	.65	74283	2.00
95	.55	74284	3.75
96	.70	74285	3.75
97	2.75	74290	.95
100	1.75	74293	.75
107	.30	74298	.85
109	.45	74351	2.25
110	.45	74365	.65
111	.55	74366	.65
116	1.55	74367	.65
120	1.20	74368	.65
121	.29	74376	2.20
122	.45	74390	1.75
123	.49	74393	1.35
125	.45	74425	3.15
126	.45	74426	.85
128	.55	74490	2.55

LINEAR

LM301	.34	LM340 (see 7800)		LM566	1.49	LM1800	2.37
LM301H	.79	LM348	.99	LM567	.89	LM1812	8.25
LM307	.45	LM350K	4.95	NE570	3.95	LM1830	3.50
LM308	.69	LM350T	4.60	NE571	2.95	LM1871	5.49
LM308H	1.15	LM358	.69	NE592	2.75	LM1872	5.49
LM309H	1.95	LM359	1.79	LM709	.59	LM1877	3.25
LM309K	1.25	LM376	3.75	LM710	.75	LM1889	1.95
LM310	1.75	LM377	1.95	LM711	.79	LM1896	1.75
LM311	.64	LM378	2.50	LM723	.49	ULN2003	2.49
LM311H	.89	LM379	4.50	LM723H	.55	LM2877	2.05
LM312H	1.75	LM380	.89	LM733	.98	LM2878	2.25
LM317K	3.95	LM380N-8	1.10	LM741	.35	LM2900	.85
LM317T	1.19	LM381	1.60	LM741N-14	.35	LM2901	1.00
LM318	1.49	LM382	1.60	LM741H	.40	LM3900	.59
LM318H	1.59	LM383	1.95	LM747	.69	LM3905	1.25
LM319H	1.90	LM384	1.95	LM748	.59	LM3909	.98
LM319	1.25	LM386	.89	LM1014	1.19	LM3911	2.25
LM320 (see 7900)		LM387	1.40	LM1303	1.95	LM3914	3.95
LM322	1.65	LM389	1.35	LM1310	1.49	LM3915	3.95
LM323K	4.95	LM390	1.95	MC1330	1.69	LM3916	3.95
LM324	.59	LM392	.69	MC1349	1.89	MC4024	3.95
LM329	.65	LM394H	4.60	MC1350	1.19	MC4044	4.50
LM331	3.95	LM399H	5.00	MC1358	1.69	RC4136	1.25
LM334	1.19	NE531	2.95	MC1372	6.95	RC4151	3.95
LM335	1.40	NE555	.34	LM1414	1.59	LM4250	1.75
LM336	1.75	NE556	.65	LM1458	.59	LM4500	3.25
LM337K	3.95	NE558	1.50	LM1488	.69	RC4558	.69
LM337T	1.95	NE561	24.95	LM1489	.69	LM13080	1.29
LM338K	6.95	NE564	2.95	LM1496	.85	LM13600	1.49
LM339	.99	LM565	.99	LM1558H	3.10	LM13700	1.49

H = TO-5 CAN T = TO-220 K = TO-3

RCA

CA 3023	2.75	CA 3082	1.65
CA 3039	1.29	CA 3083	1.55
CA 3046	1.25	CA 3086	.80
CA 3059	2.90	CA 3089	2.99
CA 3060	2.90	CA 3096	3.49
CA 3065	1.75	CA 3130	1.30
CA 3080	1.10	CA 3140	1.15
CA 3081	1.65	CA 3146	1.85
CA 3160	1.19		

TI

TL494	4.20	75365	1.95
TL496	1.65	75450	.59
TL497	3.25	75451	.39
75107	1.49	75452	.39
75110	1.95	75453	.39
75150	1.95	75454	.39
75154	1.95	75491	.79
75188	1.25	75492	.79
75189	1.25	75493	.89
75494	.89		

BI FET

TL071	.79	TL084	2.19
TL072	1.19	LF347	2.19
TL074	2.19	LF351	.60
TL081	.79	LF353	1.00
TL082	1.19	LF355	1.10
TL083	1.19	LF356	1.10
LF357	1.40		

CMOS

4000	.29	4527	1.95
4001	.25	4528	1.19
4002	.25	4531	.95
4006	.89	4532	1.95
4007	.29	4538	1.95
4008	.95	4539	1.95
4009	.39	4541	2.64
4010	.45	4543	1.19
4011	.25	4553	5.79
4012	.25	4555	.95
4013	.38	4556	.95
4014	.79	4581	1.95
4015	.39	4582	1.95
4016	.39	4584	.75
4017	.69	4585	.75
4018	.79	4702	12.95
4019	.39	74C00	.35
4020	.75	74C02	.35
4021	.79	74C04	.35
4022	.79	74C08	.35
4023	.29	74C10	.35
4024	.65	74C14	.59
4025	.29	74C20	.35
4026	1.65	74C30	.35
4027	.45	74C32	.39
4028	.69	74C42	1.29
4029	.79	74C48	1.99
4030	.39	74C73	.65
4034	1.95	74C74	.65
4035	.85	74C76	.80
4040	.75	74C83	1.95
4041	.75	74C85	1.95
4042	.69	74C86	.39
4043	.85	74C89	4.50
4044	.79	74C90	1.19
4046	.85	74C93	1.75
4047	.95	74C95	.99
4049	.35	74C107	.89
4050	.35	74C150	5.75
4051	.79	74C151	2.25
4053	.79	74C154	3.25
4060	.89	74C157	1.75
4066	.39	74C160	1.19
4068	.39	74C161	1.19
4069	.29	74C162	1.19
4070	.35	74C163	1.19
4071	.29	74C164	1.39
4072	.29	74C165	2.00
4073	.29	74C173	.79
4075	.29	74C174	1.19
4076	.79	74C175	1.19
4078	.29	74C192	1.49
4081	.29	74C193	1.49
4082	.29	74C195	1.39
4085	.95	74C200	5.75
4086	.95	74C221	1.75
4093	.49	74C373	2.45
4098	2.49	74C374	2.45
4099	1.95	74C901	.39
14409	12.95	74C902	.85
14410	12.95	74C903	.85
14411	11.95	74C905	10.95
14412	12.95	74C906	.95
14419	7.95	74C907	1.00
14433	4.18	74C908	2.00
4502	.95	74C909	2.75
4503	.65	74C910	9.95
4508	1.95	74C911	8.95
4510	.85	74C912	8.95
4511	.85	74C914	1.95
4512	.85	74C915	1.19
4514	1.25	74C918	2.75
4515	1.79	74C920	17.95
4516	1.55	74C921	15.95
4518	.89	74C922	4.49
4519	.39	74C923	4.95
4520	.79	74C925	5.95
4522	1.25	74C926	7.95
4526	1.25	74C928	7.95
		74C929	19.95

74S00

74S00	.32	74S163	1.95
74S02	.35	74S168	3.95
74S03	.35	74S169	3.95
74S04	.35	74S174	.95
74S05	.35	74S175	.95
74S08	.35	74S181	3.95
74S09	.40	74S182	2.95
74S10	.35	74S188	1.95
74S11	.35	74S189	6.95
74S15	.35	74S194	1.49
74S20	.35	74S195	1.49
74S22	.35	74S196	1.49
74S30	.35	74S197	1.49
74S32	.40	74S201	6.95
74S37	.88	74S225	7.95
74S38	.85	74S240	2.20
74S40	.35	74S241	2.20
74S51	.35	74S244	2.20
74S64	.40	74S251	.95
74S65	.40	74S253	.95
74S74	.50	74S257	.95
74S85	1.99	74S258	.95
74S86	.50	74S260	.79
74S112	.50	74S274	19.95
74S113	.50	74S275	19.95
74S114	.55	74S280	1.95
74S124	2.75	74S287	1.90
74S132	1.24	74S288	1.90
74S133	.45	74S289	6.89
74S134	.50	74S301	6.95
74S135	.89	74S373	2.45
74S138	.85	74S374	2.45
74S139	.85	74S381	7.95
74S140	.55	74S387	1.95
74S151	.95	74S412	2.98
74S153	.95	74S471	4.95
74S157	.95	74S472	4.95
74S158	.95	74S474	4.95
74S161	1.95	74S482	15.25
74S162	1.95	74S570	2.95
		74S571	2.95

IC SOCKETS

	1-99	100
8 pin ST	.13	.11
14 pin ST	.15	.12
16 pin ST	.17	.08
18 pin ST	.20	.18
20 pin ST	.29	.27
22 pin ST	.30	.27
24 pin ST	.30	.27
28 pin ST	.40	.32
40 pin ST	.49	.39
64 pin ST	4.25	call
ST = SOLDERTAIL		
8 pin WW	.59	.49
14 pin WW	.69	.52
16 pin WW	.49	.49
18 pin WW	.99	.90
20 pin WW	1.09	.98
22 pin WW	1.39	1.28
24 pin WW	1.49	1.35
28 pin WW	1.69	1.49
40 pin WW	1.99	1.80
WW = WIREWRAP		
16 pin ZIF	6.75	call
24 pin ZIF	9.95	call
28 pin ZIF	10.95	call

ZIF = TEXTOOL (Zero Insertion Force)

LED LAMPS

	1-99	100-up
Red	.10	.09
Green	.18	.15
Yellow	.18	.15

LED DISPLAYS

HP 5082-7760	.6"	CC	1.29
MAN 72	.3"	CA	.99
MAN 74	.3"	CC	.99
FND-357 (359)	.375"	CC	1.25
FND-500 (503)	.5"	CC	1.49
FND-507 (510)	.5"	CA	1.49

VOLTAGE REGULATORS

7805T	.75	7905T	.85
7808T	.75	7908T	.85
7812T	.75	7912T	.85
7815T	.75	7915T	.85
7824T	.75	7924T	.85
7805K	1.39	7905K	1.49
7812K	1.39	7912K	1.49
7815K	1.39	7915K	1.49
7824K	1.39	7924K	1.49
78L05	.69	79L05	.79
78L12	.69	79L12	.79
78L15	.69	79L15	.79
78H05K	9.95	LM323K	4.95
78H12K	9.95	UA78S40	1.95

T = TO-220 K = TO-3
L = TO-92

DIP SWITCHES

4 POSITION	.85
5 POSITION	.90
6 POSITION	.90
7 POSITION	.95
8 POSITION	.95

INTERFACE

8T26	1.59
8T28	1.89
8T95	.89
8T96	.89
8T97	.89
8T98	.89
DM8131	2.95
DP8304	2.29
DS8835	1.99
DS8836	.99

MISC.

ULN2003	2.49
3242	7.95
3341	4.95
MC3470	4.95
MC3480	9.00
11C90	13.95
95H90	7.95
2513-001 UP	9.95
2513-002 LOW	9.95

CLOCK CIRCUITS

M5314	4.95
M5369	3.95
M5375	4.95
M58167	8.95
M58174	11.95
SM5832	6.95

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Circle 84 on Reader Service card.

Circle 48 on Reader Service card.

S-100 MEMORY BOARDS

64K STATIC RAM - Jade

Uses new 2K x 8 static RAMs, fully supports IEEE 696 24 bit extended addressing, 200ns RAMs, lower 32K or entire board phantomable, 2716 EPROMs may be subbed for RAMs, any 2K segment of upper 8K may be disabled, low power typically less than 500ma.

MEM-99152B	*Bare board*	$49.95
MEM-99152K	*Kit less RAM*	$99.95
MEM-32152K	*32K kit*	$199.95
MEM-56152K	*56K kit*	$289.95
MEM-64152K	*64K kit*	$299.95
Assembled & Tested		add $50.00

256 RAMDISK - SD Systems

ExpandoRAM III expandable from 64K to 256K using 64K×1 RAM chips, compatible with CP/M, MP/M, Oasis, & most other Z-80 based systems, functions as ultra-high speed disk drive when used with optional RAMDISK software.

MEM-65064A	*64K A & T*	$474.95
MEM-65128A	*128K A & T*	$574.95
MEM-65192A	*192K A & T*	$674.95
MEM-65256A	*256K A & T*	$774.95
SFC-55009000F	*RAMDISK sftwr CP/M 2.2*	$44.95
SFC-55009000F	*RAMDISK with EXRAM III*	$24.95

LETTER QUALITY PRINTERS

LETTER QUALITY PRINTER - COMREX

Uses standard daisy wheels and ribbon cartridges, 16 CPS bi-directional printing, semi-automatic paper loader (single sheet or fan fold), 10/12/15 pitch, up to 16" paper, built-in noise suppression cover.

PRD-11001	*Centronics parallel*	$899.95
PRD-11002	*RS-232C serial model*	$969.95
PRA-11000	*Tractor Option*	$119.95

380Z by Data Terminals & Communications

Based on the same quality mechanism as the Comrex printer the 380Z contains electronic enhancements that allow it to print at speeds up to 32 CPS. Other features include a 48K buffer, proportional spacing, and Diablo 1640/1650/630 compatible protocol. Comes with printwheel, ribbon and users manual. Serial, parallel, and IEEE 488 interfaces standard.

PRD-11300	*380Z printer*	$1295.00
PRA-11000	*Tractor option*	$169.95
PRA-12000	*Cut Sheet Feeder*	$699.95

Printers From Jade

OKIDATA 82	*10" 120 CPS*	CALL
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OKIDATA 93	*15" 160 CPS With Graphics*	CALL
OKIDATA 83	*15" 120 CPS*	CALL
OKIDATA 84	*15" 200 CPS With Graphics*	CALL
OKIDATA 2350	*15" 350 CPS*	CALL
OKIDATA 2410	*15" 350 CPS*	CALL
DAISYWRITER 2000	*48K Daisywheel*	$1395.00
GEMINI 10	*100 CPS with Graphics*	$349.95
GEMINI 15	*15" with Graphics*	$499.95

DISK TUBS

Diskette Storage Boxes

Clear Plexiglas storage boxes for up to 75 Diskettes

MMA-505	*Holds 75 5¼" Diskettes*	$19.95
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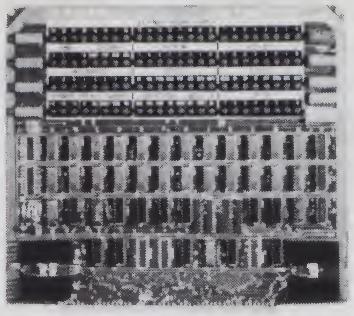

S-100 I/O BOARDS

THE BUS PROBE - Jade

Inexpensive S-100 Diagnostic Analyzer

TSX-200B	*Bare board*	$59.95
TSX-200K	*Kit*	129.95
TSX-200A	*A & T*	$159.95

I/O-4 - SSM Microcomputer

2 serial I/O ports plus 2 parallel I/O ports.

IOI-1010B	*Bare board w/manual*	$35.95
IOI-1010K	*Kit with Manual*	$179.95
IOI-1010A	*A & T*	$249.95

I/O-5 - SSM Microcomputer

Two serial & 3 parallel ports, 110-19.2K Baud

IOI-1015A	*A & T*	$289.95

INTERFACER 4 - CompuPro

3 serial, 1 parallel, 1 Centronics parallel.

IOI-1840A	*A & T*	$314.95
IOI-1830C	*CSC*	$414.95

S-100 EPROM BOARDS

PB-1 - SSM Microcomputer

2708, 2716 EPROM board with on-board programmer.

MEM-99510K	*Kit with manual*	$154.95
MEM-99510A	*A & T with manual*	$219.95

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer with softrware.

MEM-99520K	*Kit with software*	$189.95
MEM-99520A	*A & T with software*	$249.95

NEW! CP/M PLUS 3.0

CP/M 3.0 is Digital Research's latest version of the industry standard disk operating system. It features many performance improvements, such as intelligent record buffering, improved directory handling, "HELP" facility, time date stamping of files and many more improvements. AND A TREMENDOUS INCREASE IN SPEED!!! it is fully CP/M 2.2 compatible and requires no changes to your existing application software. Available only to Versafloppy II owners with SBC-200 CPU's

SFC-55009059F	*Unbanked, RS232*	$250.00
SFC-55009058F	*Unbanked, VDB8024*	$250.00
SFC-55009057F	*Banked, RS232*	$250.00
SFC-55009056F	*Banked, VDB8024*	$250.00
SFC-55009057D	*Manual*	$50.00

DUAL DISK SUB-SYSTEMS

Disk Sub-Systems - Jade

Handsome metal cabinet with proportionally balance flow system, rugged dual drive power supply, power c kit, power switch, line cord, fuse holder, cooling fan, ne mar rubbr feet, all necessary hardware to mount 2-8" drives, power supply, and fan, does not include signal c

Dual 8" Sub-Assembly Cabinet

END-000420	*Bare cabinet*	$4
END-000421	*Cabinet kit*	$19
END-000431	*A & T*	$24

8" Sub-Systems - Single Sided, Double Density

END-000423	*Kit w/2 Siemens FD100-8Ds*	$65
END-000424	*A & T w/2 Siemens FD100-8Ds*	$69
END-000433	*Kit w/2 Shugart SA-801Rs*	$99
END-000434	*A & T w/2 Shugart SA-801Rs*	$119

8" Sub-Systems - Double-Sided Double-Density

END-000426	*Kit w/2 Qume DT-8s*	$122
END-000427	*A & T w/2 Qume D-8s*	$142
END-000436	*Kit w/2 Shugart SA-851Rs*	$127
END-000437	*A & T w/2 Shugart SA-851Rs*	$147

8" SLIMLINE SUB-SYSTEMS

Dual Slimline Sub-systems - Jade

Handsome vertical cabinet with scratch resistant b enamel finish, proportionally balanced air flow system, cooling fan, rugged dual drive power supply, power ca power switch, line cord, fuse holder, cooling fan necessary hardware to mount 2-8" slimline disk drives, not include signal cable.

Dual 8" Slimline Cabinet

END-000820	*Bare cabinet*	$5
END-000822	*A & T w/o drives*	$17

Dual 8" Slimline Sub-Systems

END-000823	*Kit w/2 SS DD*	$91
END-000824	*A & T w/2 SS DD*	$94
END-000833	*Kit w/2 DS DD*	$114
END-000834	*A & T w/2 DS DD*	$117

S-100 CPU BOARDS

SBC-200 - SD Systems

4 MHz Z-80A CPU with serial & parallel I/O, 1K RA ROM space, monitor PROM included.

CPC-30200A	*A & T*	$3

THE BIG Z - Jade

2 or 4 MHz switachable Z-80 CPU board with serial accommodates 2708, 2716, or 2732 EPROM, baud rates 75 to 9600.

CPU 30201B	*Bare board w/manual*	$
CPU-30201K	*Kit with Manual*	$1
CPU-30201A	*A & T with Manual*	$1

2810 Z-80 CPU - C.C.S.

2 or 4 MHz Z-80 CPU with serial IO port & on board mo PROM, front panel compatible.

CPU-30400A	*A & T with PROM*	$2

CPU-Z CompuPro

2 or 4 MHz Z80A CPU, 24 bit addressing.

CPU-30500A	*2/4 MHz A & T*	$2
CPU-30500C	*3/6 MHz CSC*	$3

8085/8088 - CompuPro

Both 8 & 16 bit CPUs, standard 8 bit S-100 bus, up to 8 accesses 16 Megabytes of memory.

CPU-20510A	*6 MHz A & T*	$39
CPU-20510C	*6/8 MHz CSC*	$49

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M-551001		$219.95 ea	2 for **$199.95 ea**
ugart SA400L *single-sided double-density 40 track*			
M-104000		$234 95 ea	2 for **$224.95 ea**
ndon TM100-2 *double-sided double-density 48 TPI*			
M-551002		$294 95 ea	2 for **$269.95 ea**
AC FD55A *single-sided double-density 40 track*			
M-660551		*$299.95 ea*	*2 for* **$239.95**

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D-000216	*Single cab w/power supply*	**$69.95**
D-000226	*Dual cab w/power supply*	**$94.95**

-100 MOTHERBOARDS

ISO-BUS - Jade

Silent, simple and on sale - a better motherboard.

6 Slot (5¼" x 8⅝")

S-061B	*Bare board*	**$22.95**
S-061K	*Kit*	**$39.95**
S-061A	*A & T*	**$69.95**

12 Slot (9¾" x 8⅝")

S-121B	*Bare board*	**$34.95**
S-121K	*Kit*	**$69.95**
S-121A	*A & T*	**$109.95**

18 Slot (14½" x 8⅝")

S-181B	*Bare board*	**$54.95**
S-181K	*Kit*	**$99.95**
S-181A	*A & T*	**$149.95**

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emens FDD 100-8 Single-sided double-density			
F-201120		**$274.95 ea**	**2 for $249.95 ea**
ugart SA801R Single-sided double-density			
F-10801R		**$394.95 ea**	**2 for $389.95 ea**
ugart SA851R Double-sided double-density			
F-10851R		**$554.95 ea**	**2 for $529.95 ea**
me DT-8 Double-sided double-density			
F-750080		**$554.95 ea**	**2 for $529.95**
ndon TM848-1 Single-sided double-den thin-line			
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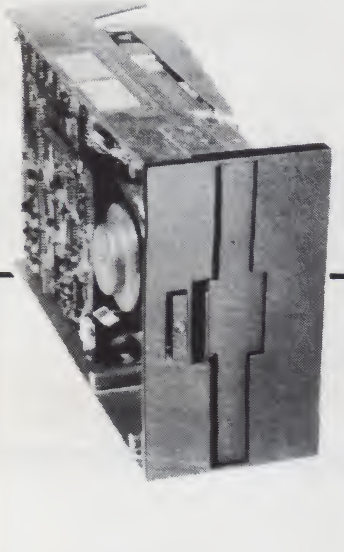
ndon TM848-2 Double-sided double-den thin-line			
F-558482		**$494.95 ea**	**2 for $484.95**
EC FD1165 Double-sided double-density thin-line			
F-851165		**$484.95 ea**	**2 for $449.95**



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SMART BUY in MODEMS - Signalman

1200 and/or 300 baud, direct connect, automatic answer or originate selection, auto-answer/auto-dial on deluxe models. 9v battery allows total portability, full one year warranty.

IOM-5600A	*300 baud direct connect*	**$89.95**
IOM-5610A	*300 baud Deluxe*	**$149.95**
IOM-5620A	*1200/300 baud Deluxe*	**$369.95**
IOM-5650A	*300 baud for Osborne*	**$119.95**
IOM-5630A	*300 baud card for IBM*	**$269.95**

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing. RS-232C interface, programmable.

IOM-5500A	*Smartmodem 1200*	**$574.95**
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IOK-1500A	*Hayes Chronograph*	**$218.95**
IOM-1100A	*Micromodem 100*	**$368.95**
IOM-2010A	*Micromodem II w/term prgm*	**$329.95**
IOM-2012A	*Terminal program for MMII*	**$89.95**

1200 BAUD SMART CAT - Novation

103/212 Smart Cat & 103 Smart Cat, 1200 & 300 baud, built-in dialer, auto re-dial if busy, auto answer/disconnect, direct connect, LED readout displays mode, analog/digital loop-back sell tests, usable with multi-line phones.

IOM-5241A	*300 baud 103 Smart Cat*	**$229.95**
IOM-5251A	*1200 baud 212/103 Smart Cat*	**$549.95**

J-CAT™ MODEM - Novation

1/5 the size of ordinary modems, Bell 103, manual or auto-answer, automatic answer/orginate, direct connect, built-in self-test, two LEDs and audio beeps provide status information.

IOM-5261A	*Novation*	**$149.95**

S-100 DISK CONTROLLERS

VERSAFLOPPY II - SD Systems

Double density disk controller for any combination of 5¼" and 8" single or double sided, analog phase-locked loop data seperator, vectored interrupts. CP/M 2.2 & Oasis compatible, control/diagnostic software PROM included.

IOD-1160A	*A & T with PROM*	**$359.95**
SFC-55009047F	*CP/M 3.0 with VF-II*	**$139.95**

DOUBLE D - Jade

High reliability double density disk controller with on-board Z-80A, auxiliary printer port, IEEE S-100 can function in multi-user interrupt driven bus.

IOD-1200B	*Bare board & hdwr man*	**$59.95**
IOD-1200K	*Kit w/hdwr & sftwr man*	**$299.95**
IOD-1200A	*A & T w/hdwr & sftwr man*	**$325.95**
SFC-59002001F	*CP/M 2.2 with Double D*	**$99.95**

EPROM ERASERS

ULTRA-VIOLET EPROM ERASERS

inexpensive erasers for industry or home.

XME-3100A	*Spectronics w/o timer*	**$69.50**
XME-3101A	*Spectronics with timer*	**$94.95**
XME-3200A	*Logical Devices*	**$49.95**

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SUPERQUAD - Adv. Micro Digital

Single board, standard size S-100 computer system, 4MHz Z-80A single or double density disk controller for 5¼" or 8" drives, 64K RAM, extended addressing up to 4K of EPROM. 2 serial & 2 parallel I/O ports, real time interrupt clock, CP/M compatible.

CPC-30800A	*A & T*	**$724.95**
IOX4232A	*Serial I/O adapter*	**$29.95**

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1000 lines, ultra-high resolution, 20 MHz ultra-high band width 9" or 12", Amber or Green phosphor, the finest monitors we sell.

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VDM-750910	*9" Amber*	**$129.95**
VDM-751220	*12" Green*	**$129.95**
VDM-751210	*12" Amber*	**$139.95**

APPLE II ACCESSORIES

DISK DRIVE For APPLE™

Totally Apple compatible, 143,360 bytes per drive on DOS 3.3 full one year factory warranty, half-track capability reads all Apple software, plugs right into Apple controller as second drive, DOS 3.3, 3.2.1, Pascal, & CP/M compatible.

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CPX-62800A	*A & T with CP/M 2.2*	**$159.95**

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IOV-2500A	*ALS Smarterm II*	**$169.95**

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=48K RAM=

w/o Pwr. Supply

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REAL-TIME CLOCK CALENDAR (MSM 5832)

$6.45 W/SPEC's

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SPECIFICATIONS	
User Memory	48K RAM
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Accessories	Accepts most Apple compatible peripherals
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12in. 18 MHz. / GREEN Phos.
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- 35 track
- with cont card

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D.C.Hayes

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7400	16	7430	17	7482	65	74126	45	74176	75
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7403	16	7436	24	7466	35	74141	49	74180	65
7404	18	7440	16	7489	3 25	74145	45	74162	75
7405	21	7443	46	7490	30	74146	1 20	74166	8 50
7406	25	7444	89	7491	35	74152	55	74190	75
7408	22	7445	55	7492	35	74153	55	74191	75
7409	17	7447	45	7493	30	74154	1 25	74192	65
7410	17	7446	55	7494	85	74155	55	74194	65
7412	21	7450	16	7495	45	74180	65	74195	75
7413	21	7451	18	74107	30	74181	65	74197	60
7414	32	7454	16	74109	38	74184	69	74221	1 10
7418	25	7472	23	74110	45	74165	69	74279	85
7420	18	7474	28	74121	28	74188	90	74293	85
7425	24	7475	36	74122	35	74173	85	74298	65
7426	29	7476	30	74123	39	74174	89	74387	55
7427	25	7460	48	74125	35	74175	75	74393	1 35
7429	40								

74LS

74LS00	21	74LS55	25	74LS139	50	74LS194	85	74LS299	1 95
74LS02	24	74Ls73	38	74LS145	1 15	74LS195	85	74Ls323	4 55
74LS03	24	74LS74	35	74LS147	1 75	74LS198	75	74LS352	1 05
74LS04	23	74LS75	38	74LS148	1 35	74LS197	75	74LS353	1 05
74LS05	20	74LS78	38	74LS151	55	74LS221	95	74LS385	45
74LS08	24	74LS78	42	74LS153	50	74LS240	95	74LS388	45
74LS09	24	74LS83	48	74LS154	1 75	74LS241	95	74LS367	75
74LS10	23	74LS85	60	74LS155	75	74LS242	95	74LS366	45
74LS11	30	74LS86	30	74LS156	75	74LS243	1 25	74LS373	90
74LS12	29	74LS90	50	74LS157	55	74LS244	85	74LS374	95
74LS13	40	74LS91	85	74LS156	65	74LS245	1 65	74LS375	75
74LS14	45	74LS92	50	74LS180	89	74LS247	1 10	74LS377	95
74LS15	29	74LS93	50	74LS161	65	74LS246	1 10	74LS376	95
74LS20	24	74LS95	85	74LS162	89	74LS249	1 10	74LS379	1 10
74Ls21	20	74LS96	69	74LS163	85	74LS251	55	74LS368	45
74LS22	24	74LS107	38	74LS164	65	74LS253	55	74LS390	1 15
74LS26	26	74LS109	38	74LS165	85	74LS257	50	74LS393	1 15
74LS27	26	74LS112	38	74LS186	1 75	74LS258	55	74LS395	1 15
74LS26	26	74LS113	36	74LS188	1 55	74LS259	1 25	74LS399	1 25
74LS30	24	74LS114	36	74LS189	1 55	74LS260	55	74LS490	1 75
74LS32	27	74LS122	45	74LS170	1 35	74LS286	55	74LS623	1 75
74Ls33	35	74LS123	65	74LS173	85	74LS273	1 45	74LS666	1 25
74LS37	30	74LS125	45	74LS174	55	74Ls279	45	74LS689	1 25
74LS38	32	74LS128	48	74LS175	85	74LS280	1 85	74LS670	1 45
74LS42	45	74LS132	56	74LS181	1 95	74LS283	65	74LS663	2 75
74LS48	75	74LS133	55	74LS190	89	74Ls290	95	74LS685	2 75
74LS49	75	74LS136	38	74LS191	89	74LS293	85	74LS687	3 50
74LS51	24	74LS137	65	74LS192	75	74LS295	95	74LS783	16 95
74LS54	25	74LS138	50	74LS193	75	74LS298	85		

74S

74S00	30	74S32	40	74S136	85	74S194	1 25	74S280	1 75
74S02	30	74S37	85	74S140	40	74S195	1 25	74S287	2 95
74S03	30	74S38	85	74S151	95	74S201	8 50	74S288	1 75
74S04	30	74S50	25	74S157	95	74S240	1 95	74S289	5 95
74S05	30	74S51	25	74S158	95	74S241	1 95	74S299	5 95
74S08	30	74S64	35	74S181	1 75	74S244	2 95	74S373	2 45
74S09	35	74S65	35	74S183	3 75	74S251	65	74S374	2 45
74S10	35	74S74	50	74S174	95	74S253	85	74S387	1 90
74S11	35	74S85	1 25	74S175	95	74S257	85	74S454	4 50
74S15	35	74S86	35	74S182	1 75	74S256	85	74S471	4 75
74S20	35	74S112	45	74S188	1 55	74S260	55	74S472	4 75
74S22	35	74S124	2 50	74S169	4 95	74S275	12 95	74S474	4 75
74S30	30	74S132	1 10						

LINEAR

LM300H	35
LM301N	30
LM301H	45
LM307H	45
LM308AN	2 25
LM309K	1 25
LM310	1 45
LM311	50
LM317K	3 65
LM316H	1 45
LM322	1 55
LM323K	4 95
LM324	55
LM339	99
LM348	1 25
LM358	65
LM380	1 10
LM381	1 85
LM388	1 40
LM531	1 95
LM555	27
LM558	1 10
LM558	2 45
LM565	95
LM568	1 45
LM703	75
LM709	40
LM710	75
LM711	49
LM720	1 75
LM723	55
LM733	95
LM741-8	35
LM741N-14	35
LM741H	35
LM747	65
LM775	25
1330	1 60
1349	1 75
1350	1 15
1358	1 35
1372	4 95
1456	55
1486	65
1489	85
1496	85
1889	1 55
4501	1 50
4558	75

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7805
7806
7808
7812
7818 ·85
7905
7908
7912
7918

8000

6036	2 55	6155	7 95	6212	2 95	6251A	5 75	8279	8 50
8060A	3 75	6202	24 50	6224	1 75	8255	4 45	6746-6	22 50
8085A	8 50								

RAMS

2018-200NS	4 10	2102	85	2114L-2	1 85	4118 150NS	8/13 95	4164-150NS	7 25
2101	1 95	2111	2 95	4118 200NS	8/11 95	4184 200NS	8 25		

6500-6800

8502	5 95	6800	8 25	8810	2 95	8845	12 50	6852	5 25
8522	8 75	8802	7 75	8821	3 00	8847	11 95	8880	9 50
8532	10 25	6809	12 50	8840	10 50	8850	3 25		

EPROMS

1702	3 95	2718	3 25	2532	8 25	2732	4 95	2764	12 50
2708	3 95								

Z80

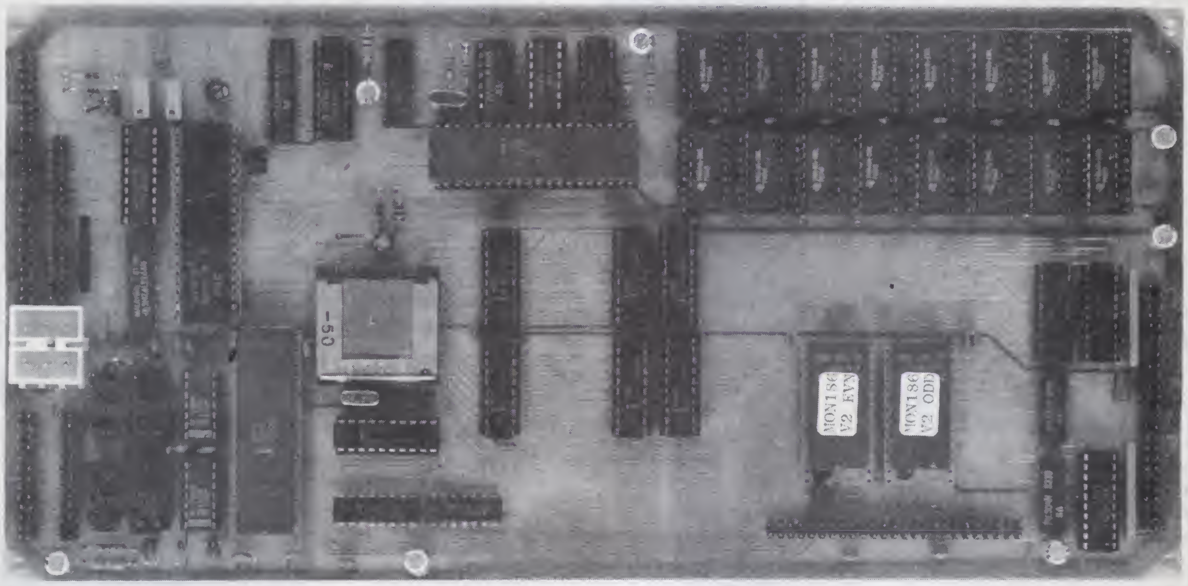
Z80CPU	3 95	Z80PIO	5 95	Z80SIO	15 50	Z80ACPU	6 00	Z80APIO	8 25
Z80CTC	5 95	Z80SIO/2	12 50			Z80ACTC	8 50		

Circle 297 on Reader Service card.

Circle 113 on Reader Service card.

STEP UP TO A 16-BIT POWERHOUSE!

"THE SLICER"



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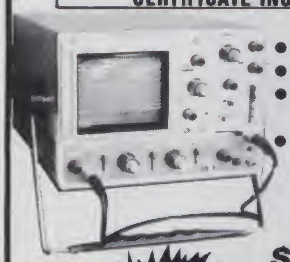

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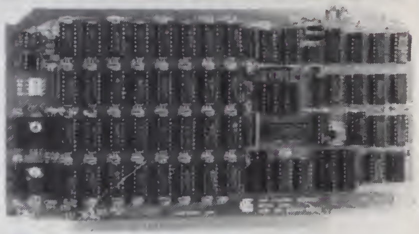

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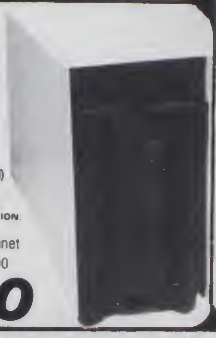

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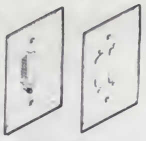
(Does not include connectors)



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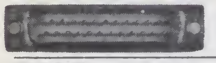

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KRCN00B51228	2 Pc. Black Hood	$1.75	$1.50	$1.35	$1.20
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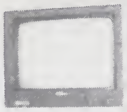

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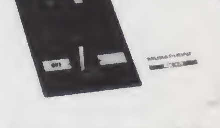

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My vote for the best advertisement in this issue goes to_______________(company) whose Reader Service number is__________

A. Which microcomputing systems do you own? Check all that apply.

- ☐ 1. Apple II, II +, III
- ☐ 2. Apple IIe
- ☐ 3. Atari 400, 800
- ☐ 4. Atari 1200 XL
- ☐ 5. Commodore VIC-20
- ☐ 6. Commodore-64
- ☐ 7. Commodore/PET
- ☐ 8. Cromemco
- ☐ 9. DEC
- ☐ 10. Franklin Ace
- ☐ 11. Heath/Zenith
- ☐ 12. Hewlett-Packard
- ☐ 13. IBM PC
- ☐ 14. Kaypro
- ☐ 15. NEC
- ☐ 16. North Star
- ☐ 17. Osborne
- ☐ 18. PMC 80/81
- ☐ 19. S-100 based system
- ☐ 20. Sanyo
- ☐ 21. Texas instruments
- ☐ 22. Timex/Sinclair
- ☐ 23. TRS-80
- ☐ 24. Xerox
- ☐ 25. Other__________

Which of the following systems do you plan to buy during the next 12 months?

- ☐ 26. Apple Lisa
- ☐ 27. Apple IIe
- ☐ 28. Atari 1200 XL
- ☐ 29. Commodore-64
- ☐ 30. Compaq
- ☐ 31. Epson HX-20
- ☐ 32. Epson QX-10
- ☐ 33. Franklin Ace
- ☐ 34. Hyperion
- ☐ 35. IBM XT PC
- ☐ 36. Morrow Micro Decision
- ☐ 37. North Star Advantage
- ☐ 38. Osborne Executive
- ☐ 39. Otrona Attache
- ☐ 40. Panasonic JR-200
- ☐ 41. Sony SMC 70
- ☐ 42. Texas Instruments Compact
- ☐ 43. Texas Instruments Professional
- ☐ 44. Timex/Sinclair 2000
- ☐ 45. TRS-80 Model 12
- ☐ 46. TRS-80 Model 16
- ☐ 47. Tandy Model 100
- ☐ 48. Zenith 100
- ☐ 49. Zorba
- ☐ 50. Other__________

B. How much have you invested in computer hardware (including peripherals) during the last 12 months?

- ☐ 1. Nothing
- ☐ 2. Under $500
- ☐ 3. $500–$1,000
- ☐ 4. $1,000–$1,500
- ☐ 5. $1,500–$2,000
- ☐ 6. Over $2,000

C. How much do you plan to spend on computer hardware during the next 12 months?

- ☐ 1. Nothing
- ☐ 2. Under $500
- ☐ 3. $500–$1,000
- ☐ 4. $1,000–$1,500
- ☐ 5. $1,500–$2,000
- ☐ 6. Over $2,000

D. How much have you invested in computer software during the last 12 months?

- ☐ 1. Nothing
- ☐ 2. Less than $100
- ☐ 3. $100–$250
- ☐ 4. $250–$500
- ☐ 5. $500–$1,000
- ☐ 6. Over $1,000

E. How much do you plan to spend on software during the next 12 months?

- ☐ 1. Nothing
- ☐ 2. Less than $100
- ☐ 3. $100–$250
- ☐ 4. $250–$500
- ☐ 5. $500–$1,000
- ☐ 6. Over $1,000

F. Do you influence friends or business associates' purchases of computing equipment?

☐ 1. Yes ☐ 2. No

G. What do you consider the *best* source of information about computers? Check one only.

- ☐ 1. Computer magazines
- ☐ 2. Other magazines
- ☐ 3. Newspapers
- ☐ 4. Books
- ☐ 5. Seminars/courses
- ☐ 6. Word of mouth
- ☐ 7 Other__________

H. If you use a microcomputer at work, what is your primary application?

- ☐ 1. Word Processing
- ☐ 2. Database Management
- ☐ 3. Other Business
- ☐ 4. Home Finance/Household
- ☐ 5. Education
- ☐ 6. Scientific/Technical
- ☐ 7. Programming/Data Processing
- ☐ 8. Hardware Design
- ☐ 9. Graphics
- ☐ 10. Other__________

I. For the most part, the articles in *Microcomputing* are

☐ 1 Too simple ☐ 2. Too complex ☐ 3. Just right

L. Which of the following columns do you read? Please rate them on a scale of 1 (seldom read) to 5 (always read).

- ____1. Publisher's Remarks
- ____2. What's New, Big Blue?
- ____3. Dial-up Directory
- ____4. PET-pourri
- ____5. Micro Software Digest
- ____ 6. Conversions
- ____ 7. Book Reviews
- ____ 8. New Software
- ____ 9. New Products
- ____10. Software Reviews

M. If you are not a subscriber, please circle 500.

vertised in this issue. Refer to the ad. You will find numbers near the logo of each advertiser. Each represents the advertiser's individual Reader Service number. Circle the corresponding numbers on one of the cards on this page, include your name, address & zip, and drop in a mailbox. In 4–6 weeks you'll hear from the advertiser directly.

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74LS33	14	.55
74LS37	14	.35
74LS38	14	.35
74LS40	14	.29
74LS42	18	55
74LS47	16	.75
74LS48	18	.75
74LS49	14	.75
74LS51	14	.25
74LS54	14	25
74LS55	14	.29
74LS73	14	.39
74LS74	14	39
74LS75	16	.39
74LS76	18	.39
74LS78	14	.39
74LS83	18	.65
74LS85	16	.69
74LS86	14	.39
74LS90	14	.55
74LS92	14	.55
74LS93	14	.55
74LS95	14	79
74LS96	16	.89
74LS107	14	39
74LS109	16	.39
74LS112	18	.39
74LS113	14	.39
74LS114	14	39
74LS122	14	49
74LS123	16	79
74LS125	14	49
74LS126	14	49
74LS132	14	59
74LS133	16	.59
74LS136	14	.39
74LS138	16	59
74LS139	16	.59
74LS151	16	59
74LS153	16	59
74LS154	24	99
74LS155	16	69
74LS156	16	69
74LS157	16	69
74LS158	16	59
74LS160	16	69
74LS161	16	69
74LS162	18	.69
74LS163	18	69
74LS164	14	.69
74LS165	18	1.19
74LS168	16	1.19
74LS169	18	1.19
74LS17D	16	1.49
74LS173	16	69
74LS174	16	59
74LS175	18	.59
74LS161	24	2.49
74LS190	18	.89
74LS191	16	.89
74LS192	16	79
74LS193	18	.79
74LS194	16	.69
74LS195	16	.69
74LS197	14	79
74LS221	18	.89
74LS240	20	1.09
74LS241	20	1.09
74LS242	14	1.09
74LS243	14	1.09
74LS244	20	1.09
74LS245	20	1.49
74LS247	16	1.09
74LS248	16	1.09
74LS249	16	1.09
74LS251	16	.59
74LS253	16	.59
74LS257	16	.59
74LS258	18	.59
74LS260	14	.59
74LS266	14	.69
74LS273	20	1.49
74LS279	16	49
74LS283	18	69
74LS290	14	.89
74LS293	14	79
74LS298	16	89
74LS352	18	1.29
74LS353	18	1.29
74LS365	16	.49
74LS366	16	49
74LS367	18	.49
74LS368	16	49
74LS373	20	1.29
74LS374	20	1.29
74LS375	16	69
74LS386	14	45
74LS393	14	1.19
74LS399	16	1.49
74LS670	16	1.49
61LS95	20	1.49
81LS97	20	1.49

74S/PROMS*

74S00	14	.35
74S02	14	.35
74S03	14	.35
74S04	14	45
74S05	14	.45
74S08	14	.39
74S09	14	39
74S10	14	35
74S11	14	.35
74S15	14	35
74S20	14	.35
74S22	14	.35
74S30	14	.35
74S32	14	45
74S38	14	89
74S40	14	.39
74S51	14	.35
74S64	14	.39
74S65	14	.39
74S74	14	.55
74S86	14	.55
74S112	16	.55
74S113	14	.55
74S114	14	.55
74S124	16	2.95
74S133	16	.45
74S134	16	.50
74S135	16	.69
74S136	14	1.39
74S138	16	89
74S139	16	.89
74S140	14	55
74S151	16	99
74S153	16	.99
74S157	16	.99
74S158	18	.99
74S160	18	2.49
74S174	16	99
74S175	16	99
74S188*	16	1.49
74S194	18	1.49
74S195	16	1.49
74S196	14	1.49
74S24D	20	2.25
74S241	20	2.25
74S242	14	2.49
74S243	14	2.49
74S244	20	2.49
74S251	16	1.19
74S253	16	1.19
74S257	16	1.19
74S258	16	1.19
74S260	14	79
74S280	14	1.95
74S287*	16	1.95
74S288*	16	1.95
74S373	20	2.49
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74S387*	16	1.95
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74S475*	24	4.95
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74S573*	18	4.95
74S94D	20	2.49
74S941	20	2.49

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CA3010H		99
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CA3023H		3.25
CA3035H		5.95
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CA3059N	14	3.25
CA3060N	16	3.25
CA3080E	8	.89
CA3081N	16	1.49
CA3082N	16	1.49
CA3083N	16	1.49
CA3086N	14	69
CA3089N	16	1.69
CA3096N	16	1.19
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CA314DE	6	99
CA3160H		1.95
CA3401N	14	.59
CA3600N	14	3.95

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CD4000	14	.29
CD4001	**14**	**.29**
CD4002	14	.29
CD4006	14	.89
CD4007	14	29
CD4009	**18**	**.39**
C04D10	16	.39
CD4D11	14	.29
CD4012	**14**	**.15**
C04D13	14	39
C04D14	16	79
CD4015	**18**	**.39**
CD4016	14	39
C04D17	16	75
C04016	18	.79
C04D19	18	.39
C04020	18	75
CD4021	16	.79
CD4022	16	79
CD4023	14	.29
CD4024	14	.69
CD4025	14	.23
CD4026	16	2.49
CD4D27	16	.45
CD4028	16	69
CD4029	16	.79
CD4030	14	.39
CD4034	24	1.95
CD4035	16	89
C0404D	16	.79
CD4041	14	.79
CD4D42	16	69
C04043	16	79
CD4044	16	.79
C04D46	16	89
C04047	14	.89
C04048	16	.39
CD4049	**16**	**.39**
CD4050	16	.39
C04D51	16	.79
CD4D52	16	.79
C04D53	16	.79
C04D56	16	2.95
C04059	24	7.95
C04060	16	89
CD4066	14	39
C04068	14	.39
CD4069	14	29
CD4070	14	.39
CD4071	14	.29
CD4D72	14	.29
CD4073	14	.29
CD4075	14	.29
CD4076	16	.79
CD4078	14	49
CD4081	**14**	**.29**
C04082	14	.29
CD4093	14	49
CD4098	16	1.95
CD4506	16	1.19
CD4507	14	.39
CD4508	24	3.95
CD4510	16	.89
C04511	16	.89
CD4512	16	89
CD4514	24	1.79
C04515	24	1.79
CD4516	18	99
C04518	16	99
CD4519	16	39
C04520	16	79
C04526	18	1.19
CD4528	16	1.19
C04529	16	1.19
C04543	16	1.19
C04562	14	6.95
CD4566	16	1.39
CD4583	16	2.49
CD4584	14	.59
CD4723	16	1.19
CD4724	16	1.19
MC14409	16	13.95
MC14410	16	13.95
MC14411	24	11.95
MC14412	16	13.95
MC14419	16	7.95
MC14433	24	13.95
MC14538	16	1.19
MC14541	14	1.19

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Part No.	**Pins	Function	Price
CDP1802	40	CPU	$9.95
2650	40	MPU	14.95
IDM2901ADC	40	CPU—4-bit slice (Com Temp Gr)	19.95
MCS6502	40	MPU w/Clock (65K bytes mem.)	9.95
MC6802CP	40	MPU w/Clock and RAM	7.95
INS8035N-6	40	MPU—8-bit (6MHz)	5.95
INS8039N-6	40	CPU-Sgl. chip 8-bit (128 bts. Ram)	5.95
INS8040N-6	40	CPU (256 bytes RAM)	5.95
INS8070N	40	CPU (64 bytes RAM)	11.95
INS8073N	40	CPU w/Basic Micro Interpreter	14.95
P8085A	40	CPU	5.95

Z80, Z80A, Z80B, Z8000 SERIES

Part No.	**Pins	Function	Price
Z80	40	CPU (MK3880N)(780C) 2MHz	$4.95
Z80-CTC	26	Counter Timer Circuit	5.95
Z8D-DART	40	Dual Asynchronous Rec./Trans	11.95
Z80-DMA	40	Direct Memory Access Circuit	15.95
Z80-P10	40	Parallel I/D Interface Controller	5.95
Z80-S1D/0	40	Serial I/O (TxCB and RxCB Bonded)	15.95
Z80-S10/1	40	Serial I/O (Lacks DTRB)	15.95
Z80-S10/2	40	Serial I/O (Lacks SYNC8)	15.95
Z8D-S10/9	40	Serial I/O	15.95
Z80A	40	CPU (MK3880N-4)(780C-1) 4MHz	5.95
Z80A-CTC	26	Counter Timer Circuit	5.95
Z80A-DART	40	Dual Asynchronous Rec./Trans	11.95
Z80A-DMA	40	Direct Memory Access Circuit	17.95
Z80A-P10	40	Parallel I/O Interface Controller	5.95
Z80A-S10/0	40	Serial I/O (TxCB and RxCB bonded)	16.95
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Z80A-S10/9	40	Serial I/O	16.95
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Z80B-CTC	26	Counter Timer Circuit	13.95
Z808-P10	40	Parallel I/O Interface Conlroller	13.95
Z8001	48	CPU Segmented	51.95
Z8002	40	CPU Non-Segmented	55.95
Z8030	40	Serial Comm. Controller	44.95
Z8036	40	Counter/Timer & Parallel I/O Unit	29.95

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Part No.	**Pins	Function	Price
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MC6802CP	40	MPU with clock and RAM	7.95
MC6810API	24	128x8 Static RAM	3.95
MC6821	40	Peripheral Inter Adapt (MC6820)	4.95
MC6828	24	Priority Interrupt Controller	15.95
MC6830L8	24	1024x8-bit ROM (MC68A30-8)	10.95
MC6850	24	Asynchronous Comm Adapter	4.95
MC6852	24	Synchronous Serial Data Adapter	5.75
MC6860	24	0-600bps Digital MODEM	9.95
MC6862	24	2400bps Modulator	12.95
MC6880A	16	Ouad 3-state bus trans. (MC8T26)	2.25
MC68000L8	64	MPU 16-8it (8MHz)	69.95
MC68488P	40	General Purpose Int Adapter	8.95
MC68652P2	40	Multi Protocol Comm Controller	24.95
MC68661PB	28	Enhanced Prog. Comm. Int	8.95

8080A SERIES

Part No.	**Pins	Function	Price
INS8080A	40	CPU	3.95
TMS5501	40	Synchronous Data Interface (SIRC)	14.95
INS8154	40	128 Byte RAM 16-Bit I/O	13.95
INS82C06	20	Octal D Flip Flop Tri-State (74C374)	2.49
DP8212	24	8-bit Input/Output (74S412)	2.25
DP8214	24	Priority Interrupt Control	3.95
DP8216	16	Bi-Directional Bus Driver	2.25
DP8224	16	Clock Generator/Driver	2.25
DP8226	16	Bus Driver	2.25
DP8228	26	System Cont /Bus Driver (74S428)	3.49
DP8238	26	System Conlroller (74S438)	4.49
INS8243	24	I/O Expander for 48 Series	5.95
INS8245	18	16-Key Keyboard Encoder (74C922)	4.49
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INS8247	26	Display Controller (74C911)	8.95
INS8248	26	Display Controller (74C912)	8.95
INS8250N	40	Asyn. Comm Element	1D.95
DP8251	26	Prog. Comm. I/O (USART)	4.49
DP8253	24	Prog Interval Timer	6.95
OP8255	40	Prog. Peripheral I/O (PPI)	4.49
DP8257	40	Prog OMA Control	7.95
DP8259	28	Prog Interrupt Control	6.95
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DP8311	20	Octal Latched Peripheral Driver	4.95

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M-Z80	User Manual	7.50
M-CDP1802	User Manual	7.50
M-2650	User Manual	5.00
30002	1980 Nat Interface Book (640 pg)	6.95
30003	1982 Nat. Linear Book (1952 pg).	11.95
30005	1981 Nat. TTL Book (624 pg)	9.95
30008	1980 Nat. Memory Data Book (464 pg)	6.95
30011	1980 Nat Linear Applications (736 pg)	15.95
30013	1983 Zilog Data Book (641 pg)	7.95

SPECIAL FUNCTION

DS0025CN	6	Dual MOS Clock Driver (5MZ)	2.49
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INS1771N-1	40	Floppy Disk Controller	16.95
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MM58167N	24	Microprocessor Real Time Clock	8.95
MM58174N	16	Micro. Compatible Time Clock	7.95
COP402N	40	Microcontroller w/64-digit RAM and Direct LED Drive	5.95
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COP470N	20	32-seg VAC Fluor Drvr. (20-pin pkg.)	3.25

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Part No.	**Pins		Price
1103	16	1024x1 (300ns)	99
4027	**16**	**4096x1 (250ns)**	**2.49**
4116N-2	16	16,384x1 (150ns)	1.89 - 8/14.95
4116N-3	16	16,384x1 (200ns)	1.69 - 8/12.95
4116N-4	16	16,384x1 (250ns)	1.49 - 8/10.95
4164N-150	16	65,536x1 (150ns)	7.95 - 8/59.95
4164N 200	16	65,536x1 (200ns)	7.49 - 8/54.95
MM5261	16	1024x1 (300ns)	49 - 8/1.95
MM5262	**22**	**2048x1 (365ns)**	**.49 — 8/1.95**
MM5270	16	4096x1 (250ns) MK4096.	4.95
MM5280	22	4096x1 (200ns) 2107	3.95
MM5290-2	16	16,384x1 (150ns)	1.69 - 8/14.95
MM529D-3	16	16,384x1 (200ns)	1.69 - 8/12.95
MM5290-4	16	16,384x1 (250ns)	1.49 - 8/10.95
MM5298-3	16	8192x1 (200ns)	1.69

STATIC RAMS

1101	16	256x1 (650ns)	1.49
2101	22	256x4 (450ns) 8101	2.49
2102	16	1024x1 (350ns)	89
21L02	16	1024x1 (450ns) L P	1.49
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2147	18	4096x1 (70ns)	4.95
2148	18	1024x4 (70ns)	8.95
TMS4D44	18	4096x1 (450ns)	3.95
TMS4045	18	1024x4 (450ns)	3.95
5101	22	256x4 (450ns) CMOS	4.95
MM5257	16	4096x1 (450ns) 4D44	4.95
HM6116P-3	24	2048x8 (150ns) CMOS	7.95
HM6116-4	24	2048x8 (200ns) CMOS	6.95
HM6116LP-4	24	2048x8 (200ns) L.P CMOS.	7.95
7489	16	16x4 (50ns)	2.25
74C920	22	256x4 (250ns) CMOS (6551)	3.95
74C921	16	256x4 (250ns) CMOS	3.95
74C929	16	1024x1 (250ns) CMOS (6501)	3.95
74C930	16	1024x1 (250ns) CMOS (6518)	3.95
74S189	16	16x4 (35ns) 93405	1.95
74S200	16	256x1 (80ns) 93410	3.95
74S206	16	256x1 (60ns) 93411	3.95
74S289	16	16x4 (35ns) 3101	2.25
82S10	16	1024x1 (50ns) O C. (93415)	3.95
82S25	16	16x4 (50ns) O.C. (74S289)	2.25

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1702A	24	256x8 (1us)	4.95
2708	24	1024x8 (450ns)	3.95
2708-5	24	1024x8 (550ns) SM00246	2.95
TMS2516	24	2048x8 (450ns) 2716	6.95
TMS2532	24	4096x8 (450ns) NMC2532	9.95
TMS2564	28	8192x8 (450ns)	19.95
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2716	24	2048x8 (450ns)	4.95
2716-1	24	2D48x8 (350ns)	6.95
2732	24	4096x8 (450ns)	9.95
27580	24	1024x8 (450ns) single +5V	2.95
MM2764	28	8192x8 (450ns)	16.95
MM2764-3	28	8192x8 (300ns)	19.95

PROMS

74S188	16	32x8	PROM O.C. (6330-1)	1.49
74S287	16	256x4	PRDM T.S. (6301-1)	1.95
74S288	16	32x8	PROM T.S. (6331-1)	1.95
74S387	16	256x4	PROM O.C. (6300-1)	1.95
74S471	20	256x8	PROM T S. (6309-1)	5.95
74S472	20	512x8	PRDM T.S. (6349-1)	4.95
74S473	20	512x8	PROM O C. (6348)	4.95
74S474	24	512x8	PROM T.S. (DM87S296N)	4.95
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74S478	24	1024x8	PROM T.S. (T8P28S86)	8.95
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74S571	16	512x4	PROM T.S. (6306)	2.95
74S572	16	1024x4	PROM O C (6352)	4.95
74S573	16	1024x4	PROM T.S. (82S137)	4.95
82S23	16	32x8	PRDM O C (27S18)	2.95
82S115	24	512x8	PRDM T.S (27S15)	9.95
82S123	16	32x8	PROM T.S (27S19)	2.95
82S126	16	256x4	PRDM O C (27S20)	3.95
82S129	16	256x4	PRDM T.S. (27S21)	3.95
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DM87S185N	18	2048x4	PRDM T.S. (82S185)	9.95
DM87S190N	24	2048x4	PRDM O C. (82S190)	19.95
DM87S191N	24	2048x8	PRDM T S (82S191)	19.95

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DC10		Mostek DC/DC Convert +5V to -9V	2.95
MC3470P	16	Floppy Disk Read AMP System	4.95
MC1408L7	18	7-bit D/A Converter (DAC0807LCN)	2.49
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AF122-1CJ	24	Touch Tone High Band Filter	19.95
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LM335Z		Temperature Transducer	1.40
LM399H		Temp Comp Prec Ref (5ppm/C°)	5.00
AY-5-1013A	**40**	**30K Baud Uart (TR1602)**	**4.95**

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16 pin LP	.26	.24	.23
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22 pin LP	.31	.26	.26
24 pin LP	.33	.30	.28
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36 pin LP	.46	.42	.39
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16 pin SG	.47	.43	.41
16 pin SG	.53	.49	.47
24 pin SG	.69	.65	.61
28 pin SG	.61	.76	.72
36 pin SG	1.09	1.03	.97
40 pin SG	1.21	1.14	1.08

LP

SG

ST

WW

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DT1050 — Applications: Teaching aids, appliances, clocks, automotive, telecommunications, language translations, etc.

The DT1050 is a standard DIGITALKER kit encoded with 137 separate and useful words, 2 tones, and 5 different silence durations. The words and tones have been assigned discrete addresses, making it possible to output single words or words concatenated into phrases or even sentences. The "voice" output of the DT1050 is a highly intelligible male voice. Female and children's voices can be synthesized. The vocabulary is chosen so that it is applicable to many products and markets.

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DT1050 Digitalker™ . . . . $34.95 ea.

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INTERSIL

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Part No.	**Pins	Function	Price
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7D45EV/Kit*	26	Stopwatch Chip, XTL	19.95
7106CPL	40	3½ Digit A/O (LCD Orive)	9.95
7106EV/Kit*	40	IC, Circuit Board, Display	34.95
7107CPL	40	3½ Digit A/O (LEO Orive)	11.95
7107EV/Kit*	40	IC, Circuit Board, Display	29.95
7116CPL	40	3½ Digit A/O LCD Dis. HLO.	16.95
7117CPL	40	3½ Digit A/D LEO Dis. HLO.	15.95
7201IUS		Low Battery Volt Indicator	2.25
7205IPG	24	CMDS LED Stopwatch/Timer	12.95
7205EV/Kit*	24	Stopwatch Chip, XTL	14.95
7206CJPE	16	Tone Generator	4.95
7206CEV/Kit*	16	Tone Generator Chip, XTL	7.95
7207AIPD	14	Oscillator Controller	5.95
7207AEV/Kit*	14	Freq Counter Chip, XTL	7.95
7208IPI	26	Seven Decade Counter	15.95
7209IPA	8	Clock Generator	3.95
7215IPG	24	4 Func CMOS Stopwatch CKT	13.95
7215EV/Kit*	24	4 Func Stopwatch Chip, XTL	14.95
7216AIJI	28	8 Digit Univ Counter C.A	29.95
7216CIJI	26	8 Digit Freq Counter C A	24.95
7216DIPI	28	8 Digit Freq Counter C C.	19.95
7217IJI	26	4 Digit LED Up/Down Counter C A	10.95
7217AIPI	28	4 Digit LED Up/Down Counter C.C.	11.95
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74HC11	14	.69
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74HC42	16	1.39
74HC73	14	.75
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74HC75	16	.99
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74HC138	16	1.49
74HC139	16	1.49
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74HC153	16	99
74HC157	16	1.19
74HC158	16	1.59
74HC160	16	1.79
74HC161	16	1.79
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74HC165	16	2.39
74HC173	16	1.59
74HC174	16	1.39
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74C160	16	1.19
74C161	16	1.19
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LM748N	8	.59
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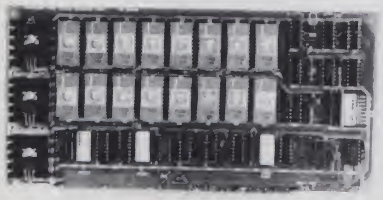

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USES 2716's

Blank PC Board - $34

ASSEMBLED & TESTED ADD $30

SPECIAL: 2716 EPROM's (450 NS) Are $4.95 Ea. With Above Kit.

KIT FEATURES

1 Uses +5V only 2716 (2Kx8) EPROM's
2 Allows up to 32K of software on line!
3 IEEE S-100 Compatible
4 Addressable as two independent 16K blocks
5 Cromemco extended or Northstar bank select
6 On board wait state circuitry if needed
7 Any or all EPROM locations can be disabled
8 Double sided PC board solder-masked silk-screened
9 Gold plated contact fingers
10 Unselected EPROM's automatically powered down for low power
11 Fully buffered and bypassed
12 Easy and quick to assemble

64K S100 STATIC RAM

$269.00 KIT

NEW!

LOW POWER!

RAM OR EPROM!

BLANK PC BOARD WITH DOCUMENTATION $55

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FULL SOCKET SET $14.50

FULLY SUPPORTS THE NEW IEEE 696 S100 STANDARD (AS PROPOSED)

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FEATURES:

- Uses new 2K x 8 (TMM 2016 or HM 6116) RAMs.
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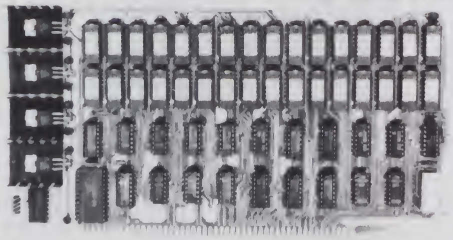
- 64K draws only approximately 500 MA.
- 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- SUPPORTS PHANTOM (BOTH LOWER 32K AND ENTIRE BOARD).
- 2716 EPROMs may be installed in any of top 48K.
- Any of the top 8K (E000 H AND ABOVE) may be disabled to provide windows to eliminate any possible conflicts with your system monitor, disk controller, etc.
- Perfect for small systems since BOTH RAM and EPROM may co-exist on the same board.
- BOARD may be partially populated as 56K.

16K STATIC RAM KIT-S 100 BUSS

PRICE CUT!

$119.95 KIT

FOR 4MHZ ADD $10



KIT FEATURES

1 Addressable as four separate 4K Blocks
2 ON BOARD BANK SELECT circuitry (Cromemco Standard!) Allows up to 512K on line!
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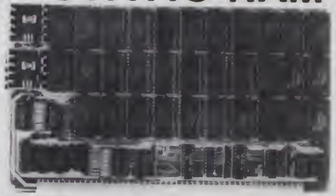

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RAM OR EPROM!

BLANK PC BOARD WITH DOCUMENTATION $52

SUPPORT ICs + CAPS $18.00

FULL SOCKET SET $15.00

56K Kit $249

64K Kit $299

ASSEMBLED AND TESTED ADD $40

FEATURES:

- Uses new 2K x 8 (TMM 2016 or HM 6116) RAMs.
- Fully supports Extended Addressing.
- 64K draws only approximately 500 MA.
- 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- Board is configured as 3-16K blocks and 8-2K blocks (within any 64K block) for maximum flexibility.
- 2716 EPROMs may be installed anywhere on Board.
- Top 16K may be disabled in 2K blocks to avoid any I/O conflicts.
- One Board supports both RAM and EPROM.
- RAM supports 2MHZ operation at no extra charge!
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At last, an S-100 Board that unleashes the full power of two unbelievable General Instruments AY3-8910 NMOS computer sound IC's Allows you under total computer control to generate an infinite number of special sound effects for games or any other program Sounds can be called in BASIC ASSEMBLY LANGUAGE, etc

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32K S100 EPROM/STATIC RAM

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EPROM II FULL EPROM KIT $80.00

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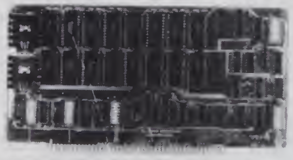

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We took our very popular 32K S100 EPROM Card and added additional logic to create a more versatile EPROM/RAM Board.

FEATURES:

- This one board can be used in any one of four ways:
  - A. As a 32K 2716 EPROM Board
  - B. As a 32K 2732 EPROM Board (Using Every Other Socket)
  - C. As a mixed 32K 2716 EPROM/2K x 8 RAM Board
  - D. As a 32K Static RAM Board
- Uses New 2K x 8 (TMM2016 or HM6116) RAM's
- Fully Supports IEEE 696 Buss Standard (As Proposed)
- Supports 24 Bit Extended Adressing
- 200 NS (FAST!) RAM'S are standard on the RAM Kit
- Supports both Cromemco and North Star Bank Select
- Supports Phantom
- On Board wait State Generator
- Every 2K Block may be disabled
- Addressed as two separate 16K Blocks on any 64K Boundary
- Perfect for MP/M* Systems
- RAM Kit is very low power (300 MA typical)

32K STATIC RAM KIT — $139.95

For RAM Kit A&T - Add $40

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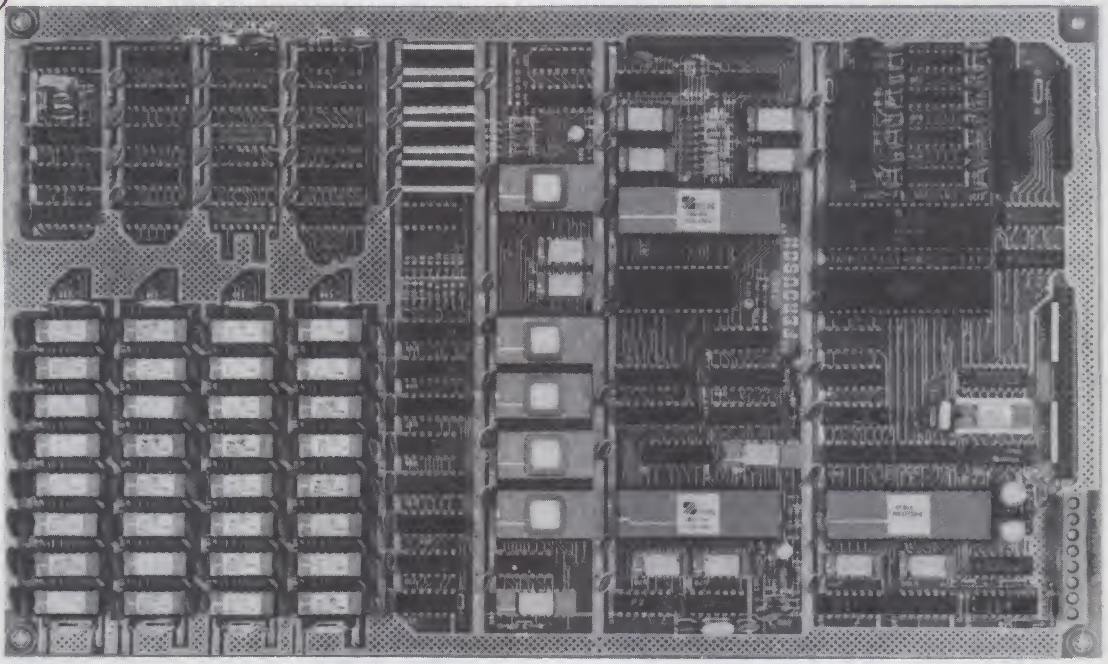

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THE BIG BOARD PROJECT: With thousands sold worldwide and over two years of field experience, the Big Board may just be one of the most reliable single board computers available today. This is the same design that was licensed by Xerox Corp. as the basis for their 820 computer.

The Big Board gives you the right mix of most needed computing features all on one board. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed.

$319.00 ** (64K KIT BASIC I/O)

SIZE: 8½ x 13¾ IN.
SAME AS AN 8 IN. DRIVE.
REQUIRES: +5V @ 3 AMPS
+ - 12V @ .5 AMPS.

FULLY SOCKETED!

FEATURES: (Remember, all this on one board!)

64K RAM

Uses Industry standard 4116 RAM's. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software.

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: $39.95

BASIC I/O

Consists of separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

BLANK PC BOARD — $119

The blank Big Board PC Board comes complete with full documentation (including schematics), the character ROM, the PFM 3.3 MONITOR ROM, and a diskette with the source of our BIOS, BOOT, and PFM 3.3 MONITOR.

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true. 5 x 7 Matrix - Upper & Lower Case.

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2.

TWO PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. Uses selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $19.95

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Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: $9.95

CP/M* 2.2 FOR BIG BOARD

The popular CP/M* D.O.S. to run on Big Board is available for $139.00.

BIG BOARD SOFTWARE SPECIAL — $149

Through special arrangement with CDL we offer a powerful package of TDL Z-80 software that has a suggested retail of almost $600. Includes: Extended Disk Business Basic, ZEDIT text editor, MACRO II Macro Assembler, LINKER, DEBUG I and DEBUG II. Supplied on 8 in. diskette with extensive manual.

PFM 3.3 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.3 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search PFM occupies one of the four 2716 EPROM locations provided. Z-80 is a Trademark of Zilog.

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TERMS: Shipments will be made approximately 3 to 6 weeks after we receive your order. VISA, MC, cash accepted. We will accept COD's (for the Big Board only) with a $75 deposit. Balance UPS COD. Add $4.00 shipping.

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THE 8086/8088 PRIMER—An Introduction to their Architecture, System Design and Programming, Second Edition by Stephen P. Morse This is written by the man responsible for the design of the 8086 microprocessor and provides novices and professionals alike with a through Introduction to Intel's 8086 and 8088 microprocessors. The book discusses architecture—the machine organization of the 8086/8088, covering register and memory structure, addressing modes and the 8086/8088 Instruction set. Chapters on programming Include a low level programming language, ASM-86, and a high level language, PL/M-86, plus the PASCAL language. BK1274 $10.95

MICROCOMPUTER DATA COMMUNICATIONS SYSTEMS by Frank J. Derfler. This text has a lot of good information on message systems and information utilities; the fundamentals of data communications, modems, terminals, and software for specific microcomputers. interesting and informative for the beginner, yet a good reference for the experienced data communications user. BK1243 $12.95

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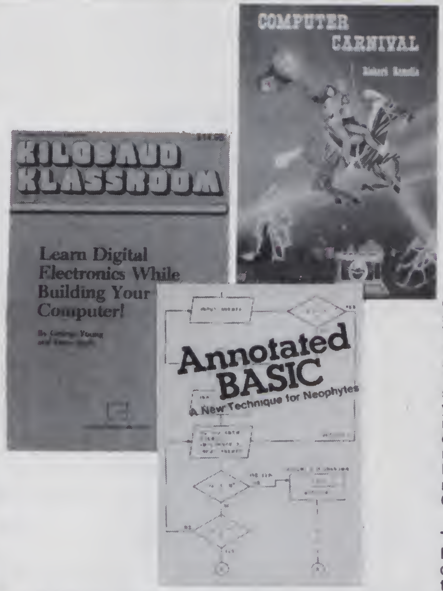
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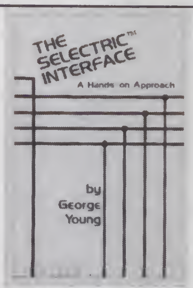

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6502/Apple/Vic

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THE CUSTOM APPLE AND OTHER MYSTERIES—by Winifred Hofacker and Ekkehard Floegel. This is *the* guide to customizing Apple software and hardware, published by the folks at IJ6. It contains such hands on information such as: data acquisition and control applications. Programming the 6522 Internal timer. Constructing the 6522 I/O board. An Eprom Burner for the Apple Computer. An Eprom/RAM board. The Apple Slot Repeater, and much, much more. BK1246 $24.95.

THE APPLE II USER'S GUIDE—By Lon Poole, Martin McNiff, and Steven Cook This guide is the key to unlocking the full power of your Apple II or Apple II Plus. Topics include: "Applesoft and Integer BASIC Programming"—especially how to make the best use of Apple's sound, color and graphics capabilities. "Machine Level Programming," "Hardware Features"—which covers the disk drive and printer, and "Advanced Programming"—describing high resolution graphics techniques and other advanced applications. Well organized and easy to use. BK1220 $16.95

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PROGRAMMING THE 6502 (Third Edition) By Rodnay Zaks—Has designed a self-contained text to learn programming, using the 6502. It can be used by a person who has never programmed before, and should be of value to anyone using the 6502. The many exercises will allow you to test yourself and practice the concepts presented. BK1005 $13.95

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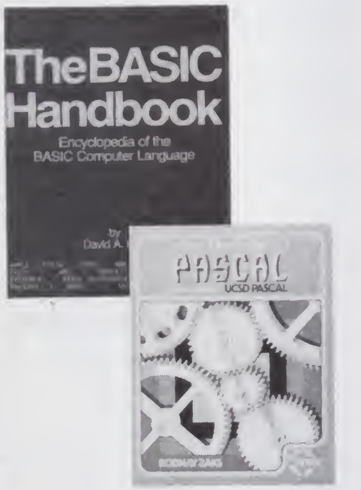

Basic/Pascal

LEARNING IBM BASIC FOR THE PERSONAL COMPUTER—by David A. Lien This is a comprehensive how-to book that will help you get the most for your IBM-PC. A completer BASIC tutorial, it puts your PC to work *while* you learn BASIC. This has been written with the beginner in mind and encourages learning in a relaxed and enjoyable manner with its easy step-by-step instructions. It's also a excellent text for the classroom. BK1273 $19.95

THE BASIC HANDBOOK—SECOND EDITION—by David Lien. This book is unique. It is a virtual ENCYCLOPEDIA of BASIC. While not favoring one computer over another, it explains over 250 BASIC words, how to use them and alternate strategies. If a computer does not possess the capabilities of a needed or specified word, there are often ways to accomplish the same function by using another word or combination of words. That's where the HANDBOOK comes in. It helps you get the most from your computer, be it a "bottom-of-the-line" micro or an oversized monster. BK1174 $19.95.*

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MICROBOOK: DATA BASE MANAGEMENT FOR THE APPLE II—by Ted Lewis This book provides you with an affordable data base management system for your Apple II. These programs turn your Apple II into a combination filing cabinet, information gathering/retrieval system and data processing engine. Written in Pascal, the program simulate a library. Information is maintained and broken down into books, chapters and pages and index to pages. Photographs of the Apple II screen are abundant, and they show you step-by-step the effect of each of your entries. Microbook can be used for almost any application involving the storage and retrivial of information. BK1261 $19.95

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Z-80

INSIDE LEVEL II—For machine language programmers. This is a comprehensive reference guide to the Level II ROMs, allowing easy utilization of the sophisticated routines they contain. It concisely explains set-ups, calling sequences, variable passage and I/O routines. Part II presents an entirely new composite program structure which unloads under the SYSTEM command and executes in both BASIC and machine code with the speed and efficiency of a compiler. Special consideration is given to disk systems. BK1183 $15.95.*

PROGRAMMING THE Z-80—by Rodnay Zaks. Here is assembly language programming for the Z-80 presented as a progressive, step-by-step course. This book is both an educational text *and* a self-contained reference book, useful to both the beginning and the experienced programmer who wish to learn about the Z-80. Exercises to test the reader are included. BK1122 $15.95.*

Z-80 ASSEMBLY LANGUAGE PROGRAMMING—by Lance A. Leventhal. This book thoroughly covers the Z-80 instruction set, abounding in simple programming examples illustrating software development concepts and actual assembly language usage. Features include Z-80 I/O devices and interfacing methods, assembler conventions, and comparisons with 8080A/8085 Instruction sets and interrupt structure. BK1177 $16.99.*

68000/6809

68000 MICROPROCESSOR HANDBOOK—By Gerry Kane. Whether you're currently using the 68000, planning to use it, or simply curious about one of the newest and most powerful microprocessors, this handbook has all the answers. A clear presentation of signal conversions, timing diagram conventions, functional logic, three different instruction set tables, exception processing, and family support devices provides more information about the 68000 than the manufacturer's data sheets. A stand alone reference book which can also be used as a supplement to *An Introduction to Microcomputers: Vol. 2—Some Real Microprocessors.* BK1216 $9.95

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CALENDAR

Texas Educational Conference

Texas Tech University is sponsoring the Sunbelt Educational Computing Conference, to be held June 1–4 on the University campus in Lubbock, TX. The theme of the conference will be Practical Applications and Current Issues in Educational Computing.

Short summary proposals for presentations at the conference should be sent to Dr. Cleb Maddux, College of Education, Texas Tech University, PO Box 4560, Lubbock, TX 79409.

Computer Faire in Boston

The East Coast Computer Faire will take place in Hynes Auditorium in Boston on June 3–5. The Faire will feature computer hardware, software and services for educational, entertainment and home applications.

For more information, call 800-343-2222 or 617-739-2000.

Minnesota Swapfest

North Area Repeater Association will again sponsor Minnesota's largest swapfest and exposition of personal computers and software on June 4 at the Minnesota State Fairgrounds, located on Snelling Ave., north of I-94 in Hopkins, MN. For information, call 612-420-6000.

National Educational Conference—Baltimore

The 5th Annual National Educational Computing Conference will be held June 6–8 in Baltimore, MD. The host institution for this year's conference is Towson State University. The purpose of the conference is to explore all aspects of computer use in education. Many colleges and universities will be represented, and 19 computer-related societies are cooperating in the conference organization.

For further information, contact Doris K. Lidtke, NECC-83 General Chairman, Department of Mathematics and Computer Science, Towson State University, Baltimore, MD 21204.

New Jersey Show and Flea Market

The fourth annual New Jersey-New York-Connecticut Microcomputer Show and Flea Market will be held June 11 in the Meadowlands Hilton Hotel at the New Jersey Sports Complex (exit 16W of the NJ Turnpike).

The show will feature commercial exhibitors, flea market sellers and hardware and software for all the popular systems. For more information, call the Kengore Corporation at 201-297-2526.

IBM PC in San Francisco

PC '83/West will be held June 17–19 in San Francisco's Brooks Hall/Civic Center Complex. PC '83 will bring together users, developers, distributors and retailers of PC-compatible products.

For further information, contact Northeast Expositions, 826 Boylston St., Chestnut Hill, MA 02167; telephone 800-841-7000 or 617-739-2000.

Wisconsin Educational Conference

The 1983 Microcomputers in Education Conference will be held at the University of Wisconsin in Madison on June 18. The Conference will explore issues and applications pertaining to microcomputers in elementary and secondary education.

For more information, contact Suzanne L. Zemke, Wisconsin Center for Educational Research, Room 785A, 1025 West Johnson St., Madison, WI 53706; telephone 608-263-4200.

Toronto Computer Show

The annual Toronto Computer Show will be held June 22–23 in the Automotive Building, Exhibition Place, Toronto, Ontario. For more information, call Laurie Whitsed, 416-967-6200.

DC Microcomputer Symposium

Microcomputer Systems: Tools or Toys? is the theme of the 22nd annual Technical Symposium of the Washington DC chapter of the Association for Computing Machinery. This conference will take place June 23 at the National Bureau of Standards in Gaithersburg, MD.

The conference is an opportunity for users, students, specialists and scholars to exchange ideas on the theme. For registration or other information, call Lorraine Lynch Nagy at 301-972-4739 (home) or 202-676-0037 (office).

EastCon in New Jersey

The EastCon gaming organizations convention will take place June 24–26 at Glassboro State College in Glassboro, NJ. Computer games are one of the features of the convention. For further information, send a SASE to EastCon, PO Box 139, Middletown, NJ 07748.

Chicago Graphics Conference

NCGA '83, a conference sponsored by the National Computer Graphics Association, will take place June 26–30 in McCormick Place, Chicago.

For more information, contact Nancy LeFebvre, NCGA, 8401 Arlington Blvd., Fairfax, VA 22031; telephone 703-698-9600.

CE '83 at Rutgers

A conference on computers in education will be held June 27–29 at Rutgers University in New Brunswick, NJ. This will be a component of Computers in Education '83, a summer institute for educators, which will run from June 20 through July 15.

For further information, call Dr. Mitchell Batoff at the Institute for Professional Development, 245 Nassau St., Princeton, NJ 08540; telephone 609-924-8333.

Toronto Computerfest

Computerfest '83 will be held July 8–10 at Harbourfront in Toronto. The event is sponsored by TRACE (Toronto Region Association of Computer Enthusiasts) and will be the largest non-professional computer show in Canada in 1983.

The show will feature exhibits, a flea market, an auction and numerous talks. For further information, write TRACE, PO Box 6922, Toronto, Ontario, Canada M5W 1X6.

Computers in Music Education—Chicago

On July 10–11, the Chicago Area Music Teachers Association and Triton Community College will host a conference on "The Role of Microcomputers in Music Education."

The show will include an exhibit and many talks and seminars on computer-assisted music education, supporting software, languages and other topics. For more information, call Pearl Anshell, the conference coordinator, at 312-386-7733, or Michael Ferrelli, the director of program development, at Triton College, 312-456-0300.

Graphics Conference and Show—Detroit

SIGGRAPH '83, the tenth annual Conference on Computer Graphics and Interactive Techniques, will take place July 25–29 in Cobo Hall in Detroit, MI. All aspects of computer graphics technology will be explored.

A public exhibition of artists' computer-generated works will be held in conjunction with the conference. For further information, call Lynn Valastyan or Sheila Hoffmeyer at 312-644-6610.

Music Instruction Workshop—Illinois

The University of Illinois will sponsor its third annual workshop on computer-based music instruction on July 26–29 at the campus in Urbana, IL. The workshop is designed for public school and university music teachers interested in learning about computers.

For registration or other information, write Professor Dale Kimpton, School of Music, University of Illinois, Urbana, IL 61801, or telephone 217-333-2620.

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DB Management for the Apple II
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Microbook: Database Management For the Apple II Computer

Ted G. Lewis
dilithium, 1982
11000 S.W. 11th St.
Beaverton, OR 97005
Paperback, 307 pp., $19.95

Database management can change not only the way you organize your work and the way you work with microcomputers, but your outlook on life's problems. You pay for it, too—prices for database management systems (the day is past when they were referred to simply as programs) run from the low hundreds of dollars into the high hundreds of dollars.

Microbook is a large set of Pascal routines that comprises a complete database system. Surprisingly, no secret is made as to what *Microbook* is: 60 percent of the book consists of the actual Pascal program listings that are the total Microbook system.

Since this all runs under UCSD Pascal, an Apple II language card is required.

For those who doubt their ability to key in 192 pages of Pascal without error, there is a pre-addressed order card in the back of the book (no postage necessary) to order the source code on two disks for $49.95. An additional $15.95 will bring you the object code ready to run; this will save the user the pain of compiling all that Pascal to p-code. These prices put *Microbook* among the most reasonably priced database systems.

Some of the crucial questions concerning database systems are:

- What type of database is it?
- Does it work?
- How big of a computer does it take?
- Does it take a genius to run it?
- How can a user use it?

The answer to the first question is fairly simple: it is ". . . a combination of both relational and hierarchical structures . . ."

That means that it is neither a network nor a sequential file form of database. It also means that the database is defined as a hierarchical library that fits the mold of the problem from which information is retrieved in a relational manner. (That is, ask for data by name and the computer spits it out for you.)

That particular question is loaded in several ways. Relational databases are easy to use but tend to be slow. Hierarchical databases are highly organized and do their work quickly, but more conscious attention must be paid to their organization.

Network databases work rapidly and are effective in large sizes on mainframe computers, but they need the attention of a database specialist to keep them in order. Sequential files are the old-fashioned way of storing data that has to be completely rewritten from front to back occasionally in order to update them.

Author Ted G. Lewis apparently aimed for the best of all possible worlds while still having something that he could use in his computer science courses at Oregon State University.

The *Microbook* organization follows the nomenclature of the world of books: the database is referred to as a "library" and a file within the database is called a "book." In this context, *Microbook* maintains a data dictionary that is an index to all "books," "chapters" and "pages" within the "library."

Does *Microbook* work? Lewis, in the preface, states that "These programs are complete and ready to run. They were tested over a one-year period before they were made available to the public." The answer seems to be a solid yes, although the programs aren't guaranteed to be free of bugs.

How big of a computer does this database take? The bigger, the better (in terms of both internal memory and disk memory). However, the Apple II with 64K memory and two disk drives appears to be close to the minimum that anyone might want to use in a database application.

Does it require a genius to run it? Familiar phrases (books, chapters, pages, forms) in lieu of the specialized jargon of database professionals argue strongly that Lewis had the needs of his students in mind as he created *Microbook*. Putting it into the Apple II and hanging it onto the UCSD Pascal p-code structure says much about what it is intended to be: a personal database system.

How can a user use it? Now here's the question that *Microbook*—with its 212 pages of text and 83 photographs of screen displays—is intended to answer. This book is a database primer and user's manual. It does not, however, tell anyone how to use Pascal; the user must know beforehand.

The crux of the matter, though, is discovering what an individual can do with a database system. This one can be used to file data, retrieve data, perform data processing and serve as a program development tool.

Examples are given of applications with such suggestive titles as Payroll, Billing and Accounts Receivable. Some suggested applications are given on p. 14: a record-collection library, a building contractor estimation, musical scores, family trees, sports statistics, a tax database, foreign language translations, grocery lists and menus, stock market histories, educational testing and quizzes, and dating service lists.

Developing applications is a matter of devising data structures for data entry, providing for data entry, extracting data from the database and providing reporting forms and structures for the user's output. A cost-effective use of a database system must pay for data entry and applications development (start-up costs included) vs existing methods of doing the task or not having the application results at all.

Microbook seems to have two potential problems. One centers on the heavy use of passwords for security of data. The other is an apparent tendency of the system to back out of ungraceful situations (such as the user not being able to remember his passwords). If these pop up frequently, users might be tempted to forget the whole project.

Serious programmers who may wish to build business systems with *Microbook* should closely investigate chapter 9, concerning the QUERY language, and chapter 12, which gives an Accounts Receivable example. The Apple IIe may prove to be an admirable machine for the purpose.

James Derry
Akron, OH

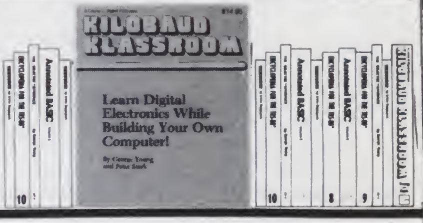
WAYNE GREEN BOOKS

KILOBAUD KLASSROOM

by George Young and Peter Stark

Makes learning electronics fun and easy. First published as a series in *Kilobaud Microcomputing*, the book combines the learning of essential theory with practical, hands-on experience. The course begins with basic electronic projects and culminates in the construction of your own programmable microcomputer. The direct instructional methods of authors Young & Stark make KILOBAUD KLASSROOM a simple way for you to acquire a solid background in digital electronics.

BK7386 (419 pages)..$14.95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Learn Digital Electronics While Building Your Own Computer!
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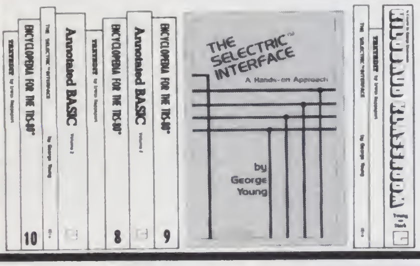
THE SELECTRIC INTERFACE by George Young



You need the quality print that a daisy wheel printer provides but the thought of buying one makes your wallet wilt. The SELECTRIC^{TM} INTERFACE, a step-by-step guide to interfacing an IBM Selectric I/O Writer to your microcomputer, will give you that quality at a fraction of the price. George Young, co-author of *Kilobaud Microcomputing* magazine's popular "Kilobaud Klassroom" series, offers a low-cost alternative to buying a daisy wheel printer. The SELECTRIC INTERFACE includes: step-by-step instructions, tips on purchasing a used Selectric, information on various Selectric models, including the 2740, 2980, and Dura 1041, driver software for Z80, 8080, and 6502 chips, tips on interfacing techniques. With The SELECTRIC INTERFACE and some background in electronics, you can have a high-quality, low-cost, letter-quality printer. Petals not included.

BK7388 (125 pages)..$12.97

TEXTEDIT

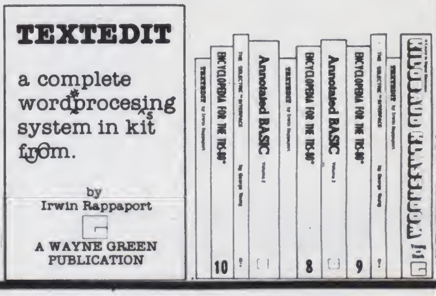
A Complete Word Processing System in Kit Form

by Irwin Rappaport

TEXTEDIT is an inexpensive word processor that can be adapted to suit your differing needs—from form letters to lengthy texts. Written in TRS-80 Disk BASIC, the system consists of several modules, permitting the loading and use of only those portions needed. A disk is also available which provides the direct loading of the modules, however, the book is required for documentation. For Model I and III with TRSDOS CONVERT., one disk drive (2 disk drives or copy utility needed to transfer to system disk). Runs under TRSDOS 2.2/2.3. May not function under other systems.

BK7387 (book, 90 pages)..$9.97
DS7387 (disk)..$19.97

Disk is manufactured by Instant Software, a division of Wayne Green Inc.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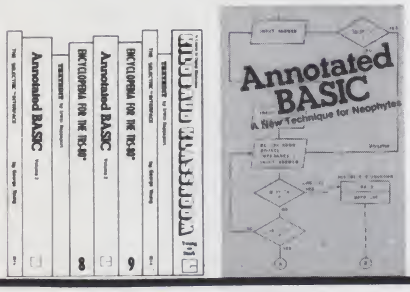
ANNOTATED BASIC

A New Technique for Neophytes

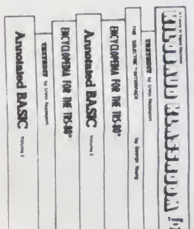


Put your BASIC knowledge to work for you with this 2-volume set of TRS-80 Level II BASIC programs. Gain a better understanding of the elements and techniques involved in programming. ANNOTATED BASIC'S uniquely designed format breaks each program down for you to include: initial documentation and instruction, definitions of New BASIC Concepts, flowchart, annotations of sections, showing how each part fits into the whole, and explaining why certain BASIC commands are chosen over similar ones.

Using the programs as they are or modifying them to sharpen your programming skills, ANNOTATED BASIC is a helpful tool for any BASIC programmer.

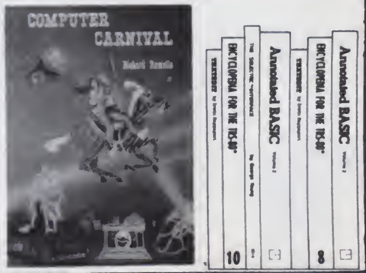
BK7384 (Vol. 1, 152 pages)..$10.95
BK7385 (Vol. 2, 136 pages)..$10.95

COMPUTER CARNIVAL by Richard Ramella



Your child can become a crackerjack computerist with the sixty TRS-80 Level II programs in COMPUTER CARNIVAL. This large-type, spiral bound book for beginners is a veritable funhouse of games, graphics, quizzes and puzzles. Written by *80 Micro* columnist Richard Ramella, the programs are challenging enough to ensure continued learning, yet short enough to provide your child with the immediate delight and reward of mastering basic computing skills. And for even greater enjoyment, get the CARNIVAL COMPANION, a 30-minute cassette containing all the programs in the book. Eliminates tiresome typing and lets your child spend more time enjoying the programs.

BK7389 Book (218 pages)..$16.97
CC7389 Book & Cassette "Carnival Companion"........................$24.97



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Computers in Number Theory

Donald D. Spencer
Computer Science Press, 1982
11 Taft Court
Rockville, MD 20850
Paperback, 250 pp., $13.95

For someone who's interested in math but has a limited computing background, *Computers in Number Theory* would be a valuable purchase. And, for a person with a computer background but with marginal theoretical math experience (like me), it's still interesting and entertaining. (I've always wondered what you do with computers besides type on them.)

Chapter 1 ("Meeting the Computer") begins with a little number theory. A couple of computers and terminals are shown, along with a nice picture from IBM of a woman pondering over a flowchart.

A complete Basic course—in 79 pages—is provided in Chapter 2, which is well-written and surprisingly complete. It's better than several Basic books I've read or used as classroom texts.

Chapter 3 discusses prime numbers, which are evenly divisible only by themselves and by 1, and which are generally useless. My guess is, though, that prime numbers are to mathematicians as catnip is to a barnyard tabby.

Many math departments at the college level teach Basic by having students write programs that find primes; this chapter presents that problem as the first programming example. (The author must be a mathematician by trade.) In any event, good programming practice is demonstrated.

Mathematical subjects are covered in the succeeding chapters: "Magic Curios," "Factoring," "Fibonacci Numbers," "Magic Squares," "Computers and Their Numbering Systems," "Modular Arithmetic" and "Number Theory for Fun." The book finishes off with an excellent glossary of computer terms and a comprehensive index.

If you think *Computers in Number Theory* involves only mathematics—and in particular, math that's a little on the fun side—you're half right. It *does* involve mathematics on the fun side. But it's also a subtle form of software training. It includes more than 80 Basic programs demonstrating puzzle-solving using a computer.

Computers in Number Theory is an excellent way to stretch your software wings while picking up a little math along the way.

Jim Hansen
New Boston, NH

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A Programmer's Notebook: Utilities for CP/M-80

David Cortesi
Reston, 1983
11480 Sunset Hills Road
Reston, VA 22090
Paperback, 368 pp., $16.95
Clothbound, $21.95

Inside CP/M: A Guide For Users and Programmers With CP/M-86 and MP/M-2

David Cortesi
Holt, Rinehart and Winston, 1982
383 Madison Ave.
New York, NY 10017
Paperback, 571 pp., $23.95

Your IBM Personal Computer: Uses, Applications and Basic

David Cortesi
Holt, Rinehart and Winston, 1982
383 Madison Ave.
New York, NY 10017
Paperback, 252 pp., $17.50

David Cortesi is a known commodity in the world of CP/M, and his expertise shows in his books *A Programmer's Notebook: Utilities for CP/M-80* and *Inside CP/M: A Guide for Users and Programmers*. Unfortunately, the same is not true of his book *Your IBM Personal Computer: Uses, Applications and Basic*.

It is my feeling that Holt, Rinehart and Winston (HR&W), on the heels of the successful *Inside CP/M*, and seeing that the publication market was ripe for *anything* about the IBM PC, asked Cortesi simply to put a book together as completely and speedily as possible.

Your IBM Personal Computer reflects that perspective. It's a slapdash adaptation of IBM's *Guide to Operations* for the PC, and neither the publisher nor Cortesi was careful enough to ensure that the material went together in an orderly, accurate fashion.

In fairness to Cortesi, this book *is* an easy introduction to the world of computing and the IBM PC. But HR&W should have anticipated that the audience for this book would be made up of people who want to read about a system *before* they buy it. Instead, it seems to aim for the person who already has bought an IBM PC.

The information presented is accurate, and some of it is even germane, but most of it is easily culled from other sources.

The book's treatment of the Basic language is fairly well-done and technically accurate. However, Cortesi is an assembly language programmer, and his use of the Basic language reflects his experience. Everything written in Basic will work, of course, and the presentation of the instructions is certainly accurate, but the style just isn't the style of a novice Basic programmer. The cryptic style of Cortesi's Basic programming isn't even a good model for the accomplished Basic programmer.

Plenty of PC survey books are hitting the market. This one takes its place with the lesser of them. It's market may be buoyed by the fact that HR&W is doing a series on the PC, hopefully with books of better quality. Cortesi is simply out of his element on this one.

The same cannot be said for Cortesi's new CP/M books.

In CP/M, Cortesi is definitely in his element; consequently, both of these books are musts for any serious CP/M assembly programmer. There's knowledge even for the CP/M user who may not wish to become enmeshed in the assembly language.

Inside CP/M must be rated as a landmark work. Cortesi dissects and systematically explains the CP/M operating system—in language meaningful to a person of moderate technical ability.

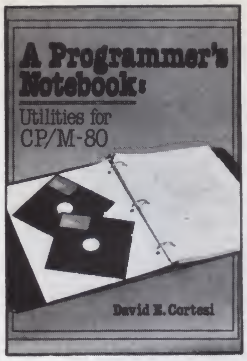
Cortesi acknowledges the quality of his audience and the plan of his book in the preface, and then proceeds to give us 500-plus pages of solid CP/M facts, treating not only the technical topics necessary to use the system, but also the user/managerial topics that are a part of any effective information-processing activity.

It was refreshing to read of disaster planning and data security, both of which are beginning to rear their ugly heads in the world of small-business computing.

As a basis for comparison, I matched *Inside CP/M* to the presentation of CP/M in the reference manual of the Osborne 1 computer. I wish Osborne had hired Cortesi to do its manual. Not only has he presented the features of the system with sufficient instruction as to their use, he has illustrated the book with pictures, listings, tables and six pages of an internally imbedded index (to Part I), which provides quick location of needed knowledge. Even the table of contents serves as an easy topical locator.

The second part of the book is a reference manual. Each command, each assembler command, each module construct is treated with clarity and completeness. It's by far the best CP/M reference guide I've seen.

The book also makes reference to CP/M-86 and MP/M-2, essentially where those elements are unique and are not treated in the general discussion of CP/M. While that information is good information, the inclusion of those topics is a marketing effort to broaden the scope of the book's audience. Hopefully, HR&W will see the wisdom of producing parallel books of this quality and completeness for both CP/M-86 and MP/M-2.



In *A Programmer's Notebook: Utilities for CP/M-80*, Cortesi developed a variety of useful utility programs and documented them fully. Beginning with pseudocode, he defines several functions that are necessary if the CP/M asembly programmer is to obtain maximum use from the machine.

A Programmer's Notebook is not for the faint of heart or the novice user. To make effective use of this book, you must know something about the machine you're using, the CP/M operating system itself and the Z-80 assembler language. Since much of the CP/M system is installed on the Z-80, the things Cortesi shares are of immediate and practical value.

What Cortesi has done is to develop utilities that you would develop yourself, given the time. In the process, he teaches CP/M's advanced features and those things necessary to pursue the "craft" of computer programming with "efficiency, elegance and beauty."

In the book, Cortesi shows you how to dump ASCII files, with and without control characters, and how to dump binary files. He develops, with the reader, the assembly language programs necessary to perform these functions and others.

Data compression techniques are explored, as well as how to expand from compressed files. Cortesi even goes so far as to tell you how to insert and remove tab characters. (I didn't know why I needed to know that until I read this book.)

The programs necessary to work with the disk directories come next. They can be read, listed, translated to ASCII and allocated using these utilities.

Finally, Cortesi shows at length the great power of the macro specification capabilities of CP/M and the assembly language and the proper ways to use the CP/M macro libraries.

The book advertises that it imparts the techniques needed to create professional-quality programs in 8080 assembly language. It does that.

It boasts that you'll be able to build up an impressive software library that would cost you a fortune if purchased elsewhere. That claim should be met with skepticism.

But what should not be met with any question is the capability of this book and the value of the information it imparts.

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NEW SOFTWARE

Edited by Dan Muse

All-Purpose Package

Information Reduction Research (1538 Main St., Concord, MA 01742) has released QuesText III—a software package for business people, educators, scientists, systems developers and microcomputer users at all levels.

QuesText III is designed to store, organize and retrieve textual information. It is not a word processor, because it imposes structure on entered text; and it is not a database management system, because its structure is invisible to the user.

QuesText is completely menu-driven and requires no programming knowledge or specialized ability. The software is intended for all users, from system developers to novices. Prompts and other aids are designed to accommodate all user levels.

QuesText III can be used for something as simple as notetaking or as complicated as computerized question answering.

The software requires a CP/M system with 56K or an IBM PC, and a 24×80 ASCII-encoded CRT. The complete QuesText III system costs $299.95. An electronic tutorial and five applications cost $29.95. A miniversion (500 records, six lines/menu, 40 screens) is available for $49.95. Reader Service number 472.

Computer-Assisted Writing

FirstDraft is designed to offer comprehensive computer-assisted writing capabilities for every writing purpose. Never allowing you to face a blank page, FirstDraft prompts you through an evermore detailed information-gathering phase.

From the initial question, "What kind of a document do you wish to produce?", the writer is guided through the thinking process of creating a solid, intelligent document from a memo to a book.

After the details are collected, FirstDraft structures the document into a working outline that may be changed at will. The outline is then assembled into a "skeleton" document.

FirstDraft will interface to most eight-bit CP/M word processing systems.

Once the document is completed, FirstDraft provides reference capabilities through its automated table of contents and indexing features.

FirstDraft is available from PromptDoc, Inc., 833 W. Colorado Ave., Colorado Springs, CO 80905. It costs $195. Reader Service number 470.

Multilingual Word Processing

Lifetree Software, Inc. (411 Pacific St., Suite 315, Monterey, CA 93940), has announced The Volkswriter International Edition, a multilingual word processor.

The International Edition is a multilingual version of the original Volkswriter, and is designed for the IBM Personal Computer and compatible systems.

The system is intended for people who correspond or do business in more than one language. New features of the system include allowing scientific and engineering word processing on daisy-wheel printers, a universal and user-configurable foreign language keyboard arrangement and the ability to print foreign language characters under user control.

The Volkswriter International Edition costs $225. Reader Service number 469.

Can Software Save Teeth?

Commodore Business Machines has developed Tooth Invaders, a game designed to make kids, parents and dentists happy. Tooth Invaders combines the fun of video arcade games with the principles of dental care. The game incorporates recommendations of the American Dental Association.

The motto of Tooth Invaders is "A Clean Tooth Will Not Decay!" The object of the game is to remove the plaque dropped on the video teeth by the villain, D.K. Fortunately, Plaque-man comes to the rescue, armed with his trusty toothbrush, toothpaste, dental floss and fluoride rinse.

Plaque-man must clean away all the plaque before irreversible decay sets in and the teeth are lost; he must destroy D.K. before D.K. destroys him.

Tooth Invaders runs on the Commodore-64. For more information, contact Commodore, 487 Devon Park Drive, Wayne, PA 19087. Reader Service number 460.

SAT Prep Program

Arrow Instructional Systems' (PO Box 543, Newport, RI 02840) SAT Preparation Program is designed to be friendly enough to be used by students who have never touched a computer before.

The SAT program introduces students to the components of the exam and its directions, and challenges the high schooler with verbal and math questions. The student may concentrate on one area or choose to take a complete, simulated SAT exam.

The program has a built-in timing and scoring function that automatically converts the student's answers to an equivalent SAT score. In areas where further study is needed, the program will suggest that the student take advantage of Tutormode, a skill-building mode that gives a step-by-step analysis of how the correct answer is arrived at and why the others are incorrect.

The program's questions are replicated in the format and level of difficulty of SAT questions. The program sells for $199.95. Reader Service number 466.

Solve the Unix Paradox

LXI, Inc. (PO Box 3032, West Lafayette, IN 47906), has released a software package that is designed to solve the Unix paradox in the personal computer world: How to have Unix-like capabilities and still be able to use all the applications software developed for the computer's operating system.

The product is called LSH and is a Unix-like command processor that is fully compatible with MS-DOS and PC-DOS.

By implementing a Unix-like (hierarchical) file system, LSH solves DOS's major weakness: the "flat" file system. You can organize your files within the hierarchical file system in the same way you organize papers in a filing cabinet—by category.

By providing extensive tutorials, LSH solves one of Unix's disadvantages—poor documentation.

LSH also features Unix text-editing capabilities, which are included in the LED text editor, a project management/coordination tool (LMK) and a number of other programs, including a text formatter (LTF), sort/search and disk recovery utilities.

The LSH package, utilities included, is available for $229. It is available for the IBM Personal Computer and Victor 9000; it will soon be available for other MS-DOS systems. Reader Service number 467.

A Basic Understanding

VIC PAK #1 is a series of seven basic programs for the

Commodore VIC-20. The programs are designed to help VIC-20 owners acquire a basic understanding of programming microcomputers.

In cassette format, VIC PAK #1 loads seven programs, which are written in Basic. The seven programs are:

- Mortgage—it lets you find unknown variables for the principal, monthly payment, term, and annual interest of a mortgage loan.
- Elements—a short quiz on naming the chemical symbols associated with each of the chemical elements.
- Statistics—a brief introduction to the VIC-20 as a sophisticated calculator.
- Calendar—produces any calendar month from 1 A.D. to 9999 A.D.
- Marblestat—a program that illustrates the computer's ability to imitate real-life events via programming.
- Expectancy—a program that enables you to calculate a rough estimate of your life expectancy.
- U-Draw—a simplified graphics drawing program, in block format. On a TV screen it offers eight colors.

The VIC PAK #1 is priced at $19.95. It is available from MicroSoftware International, Inc., 50 Teed Drive, Randolph, MA 02368. Reader Service number 463.

Adding Color to Printing

ColorText, a software product that allows multicolor printing with a typeset look and a wide range of other printing effects, has been modified and expanded to increase its flexibility and utility.

The program, from Jupiter Island Corporation (1900 Powell St., Suite 1135, Emeryville, CA 94608), now includes book-style justified type, additional spacing and margin-setting features and the ability to print in 22 colors. In addition to these features, ColorText—in combination with any text editor or word processor—features six type sizes, automatic centering, micro-spacing, proportional and fixed-character spacing, subscript and superscript, reverse line spacing, a high-speed draft mode and characters for six foreign languages.

ColorText recognizes 53 commands that can be included in a text file. Because printing is entirely under software control, no intervention on your part is required.

ColorText is written for computer systems that run under CP/M or IBM PC-DOS. It is available in formats for the IBM PC, Televideo, Osborne, Northstar, Morrow Designs, Apple CP/M and eight-inch SS/SD CP/M. ColorPlus sells for $149. Reader Service number 461.

Learning Basic

Europro, Inc. (129 Saratoga, Petaluma, CA 94952), has released two educational programs for the IBM Personal Computer, EduBas I & II.

EduBas I is designed for those who want to learn how to program in Basic on the IBM PC. Using analogies and examples, EduBas I will show you:

- Immediate mode—how you can use the computer as a calculator or printer.
- Arithmetic functions—if it will answer that 6+4/2=8 or 5.
- Deferred mode—how to write a program.
- How to "talk" to a computer. How it gives you answers—input, output functions.
- Branching and looping—how you tell it to make choices, to repeat a function once or forever.
- Flowcharting—what is needed to create a program.
- An introduction to graphics.
- Subroutines—how to structure a program.
- Debugging—what to do if a program doesn't work.

EduBas II is designed to unlock the advanced functions of the Basic language of the IBM PC, such as string and substring manipulations, file manipulations (sequential and random), advanced graphics and colors, advanced Basic instructions like Common, Inkey$, Print-Using, On Error-Resume, While-Wend.

Both EduBas I & II include three disks which contain computerized lessons, exercises and instructions. Both programs require 64K, one disk drive, DOS, BasicA, the color graphics monitor adaptor and an 80-column black-and-white or color screen. EduBas I costs $95; EduBas II sells for $105. The two packages can be purchased together for $170. Reader Service number 471.

Five Commodore Packages

Midwest Software (Box 214, Farmington, MI 48024) has announced five software products for the CBM/PET and the Commodore-64 computers. They are Script Ease, Datalog, Date Due, Multiple Choice and Ledger.

Script Ease ($39.50) is a 40-column word processor designed to be used by children, although it can be used for sophisticated word processing needs. Text can be output to the printer without any format commands. As the child learns the commands, they can be added in subsequent lessons. Script Ease requires a disk drive, printer and a CBM/PET with 32K.

Datalog ($39.50) lets you define up to 12 of your own fields and creates up to 1000 records on a 4040 disk; each record is over 200 characters long. Datalog interfaces to most popular word processors for printing form letters or labels. It also offers multiple sort and search capabilities. It has the same requirements as Script Ease.

Date Due ($39.50) is designed to manage overdue items in libraries. It prints out reports by name, date, call number, title or room number. It operates in 16K or 32K, or on the C-64. Date Due requires a disk drive, and a printer is preferred.

Multiple Choice ($29.50) creates up to 150 question-and-answer sets per disk file. Any number of questions can be selected from the bank and randomized if desired. The answer choices are always in random order. Tests can be either taken on screen or printed out on paper. An answer key is printed down the left side of paper tests, so it can be covered for xeroxing tests. Multiple Choice is available on disk only, but can be saved and used on tape. It runs in 16K, 32K or on the C-64.

Ledger ($29.50) is a package for personal finance or school revolving accounts. The Ledger prints reports sorted by journal, ledger or check register. It handles up to 300 transactions in any number of accounts. It has the same requirements as Multiple Choice. Reader Service number 465.

Math, and More Math

Micro Math is a series of educational math programs designed for use on the Timex-Sinclair 1000 (ZX-81), Commodore PET and VIC-20 computers. The programs can be used in an academic setting or in a home environment.

The programs are aimed at 12–16-year-olds. A random-program generator originates an infinite number of problems within each subject area. The problems are displayed on the screen and the student is prompted to answer the question. If the answer is correct, the student proceeds. If an incorrect answer is keyed in, the student is given a clue to the theory behind the problem and is prompted to answer again. If another incorrect answer is entered, the correct answer is displayed with a complete explanation.

Micro Math comprises six program suites, each containing four programs:

Suite 1 contains programs on factorization of algebraic equations; simple and compound interest; statistics I; and trigonometry, including sine, cosine, and tangent rules.

Suite 2 contains differentiation-calculus; solution to triangles using sine and cosine; percentages; and changing bases of numbers.

Suite 3 contains indices in algebra; similar triangles; applications of the Pythagorean Theorem; and profit and loss.

Suite 4 contains simplification of bracketed quantities in algebra; ratio and proportion; polygon properties; and graphs of linear and quadratic functions.

Suite 5 contains statistics II, solution to algebraic equations; vectors; and indices II.

Suite 6 contains geometry of the circle and its chords; matrices; operations on numbers in different bases; and simultaneous equations.

Micro Math is priced at $50 and is manufactured by PM International, PO Box 87, Buckfield, ME 04220. Reader Service number 473.

Getting Practical

Practicalc is an electronic spreadsheet program for the Commodore-64 and VIC-20 computers. The software is manufactured by Computer Software Associates, Inc., but will be distributed by Micro-Software International, Inc. (50 Teed Drive, Randolph, MA 02368).

Practicalc is designed to provide owners of VIC-20 and C-64 computers with a serious-minded program for both business and educational applications.

Practicalc lets you enter titles and numerical data into rows and columns that are displayed on the screen; then it performs a number of mathematical functions and projections.

Once the different formulas are entered for different row and/or column locations, other row/column values can be determined from previously entered values. Row/column values can also be determined from values that have been defined during the calculation process, enabling the user to make future projections.

You enter titles and numerical data into rows and columns displayed on a CRT, with a column width from three to 21. Practicalc is capable of over 20 mathematical operations, including all Basic functions as well as row and column operations (such as sum, count, max, min and avg).

Practicalc also allows numeric formulating. All numeric entries are carried to nine digits, whether displayed or not.

Up to about 600 cells on the VIC-20 can be filled with numerical data (2000 cells for VICs with 24K). Sheets may be saved, loaded and printed. Provision for sorting rows into numeric or alphabetic order is included, and individual entries can be moved.

Practicalc for the VIC-20 sells for $39.95. It costs $49.95 on the C-64. Reader Service number 414.

VIC, TS Software

Apropos Technology (350 Lantana Ave., Suite 821, Camarillo, CA 93010) has released three software packages for the VIC-20 and Timex-Sinclair 1000 (ZX-81). The packages are Wordplay, Dr. Floyd and Graphics PAC 1.

Wordplay is a group of five programs: Jargon, Story, Animal, Haiku and Secret. Jargon will write important-sounding phrases based on user-configurable menus. The phases may or may not have coherent meanings. Story is a program that will write personal short stories based on the names, places and objects you enter. Animal is a game in which the computer attempts to guess what animal you are thinking of. Haiku is a program that writes a form of Japanese poetry using user-configurable menus. Secret is a cipher/decipher program that lets you hide text by coding it, and then, with the use of a keyword, decoding it back to the original. Wordplay requires 16K and is available in cassette form for the VIC-20 ($14.95) and the TS-1000 ($10).

Dr. Floyd is a program designed to carry on a conversation with its players. It employs a psychoanalytic technique used in client-centered therapy to keep the conversation moving. This gives the appearance of artificial intelligence. It requires 16K for both the VIC-20 ($14.95) and the TS-1000 ($10).

Graphics PAC 1 is a group of five TS-1000 programs which let you draw pictures on the TV screen under direct keyboard control in many modes. Two of the programs draw "pop" art, two produce line art drawings and the last is a complete screen formatter. All programs allow you to save screen contents directly onto tape. It requires 16K and costs $10. Reader Service number 462.

Atari Programs

T.H.E.S.I.S. (PO Box 147, Garden City, MI 48135) has announced two software programs for Atari computers—Bulls and Cleots and It's About Time.

Bulls and Cleots is designed to challenge your skills of logic and deduction. You are pitted against the computer. The program defies you to enter the correct four-digit number before the computer does. You will be given clues after each entry.

Bulls and Cleots features three levels of play. At each level you can play alone, with a friend or against the computer. It is intended for anyone from age nine to 90. It requires an Atari system with 32K and is available on disk ($25) or cassette ($20).

It's About Time, developed for children between the ages of four and eight, is a drill and practice program that teaches time on both the standard analog clock and the digital clock.

The program contains three units. In one unit, the child reads a standard clock and places the correct time on a digital clock. In the second unit, the child uses a joystick to set the standard clock while reading the digital clock. Unit three is a game in which the child tries to set the clock before running out of time.

It's About Time features large, easy-to-read numbers, colorful displays of clocks, sound and animation. There are five units in each lesson with hour, half-hour, quarter-hour, five-minute and minute intervals. The programs are available on cassette (16K) for $20 and disk (24K) for $25. Reader Service number 468.

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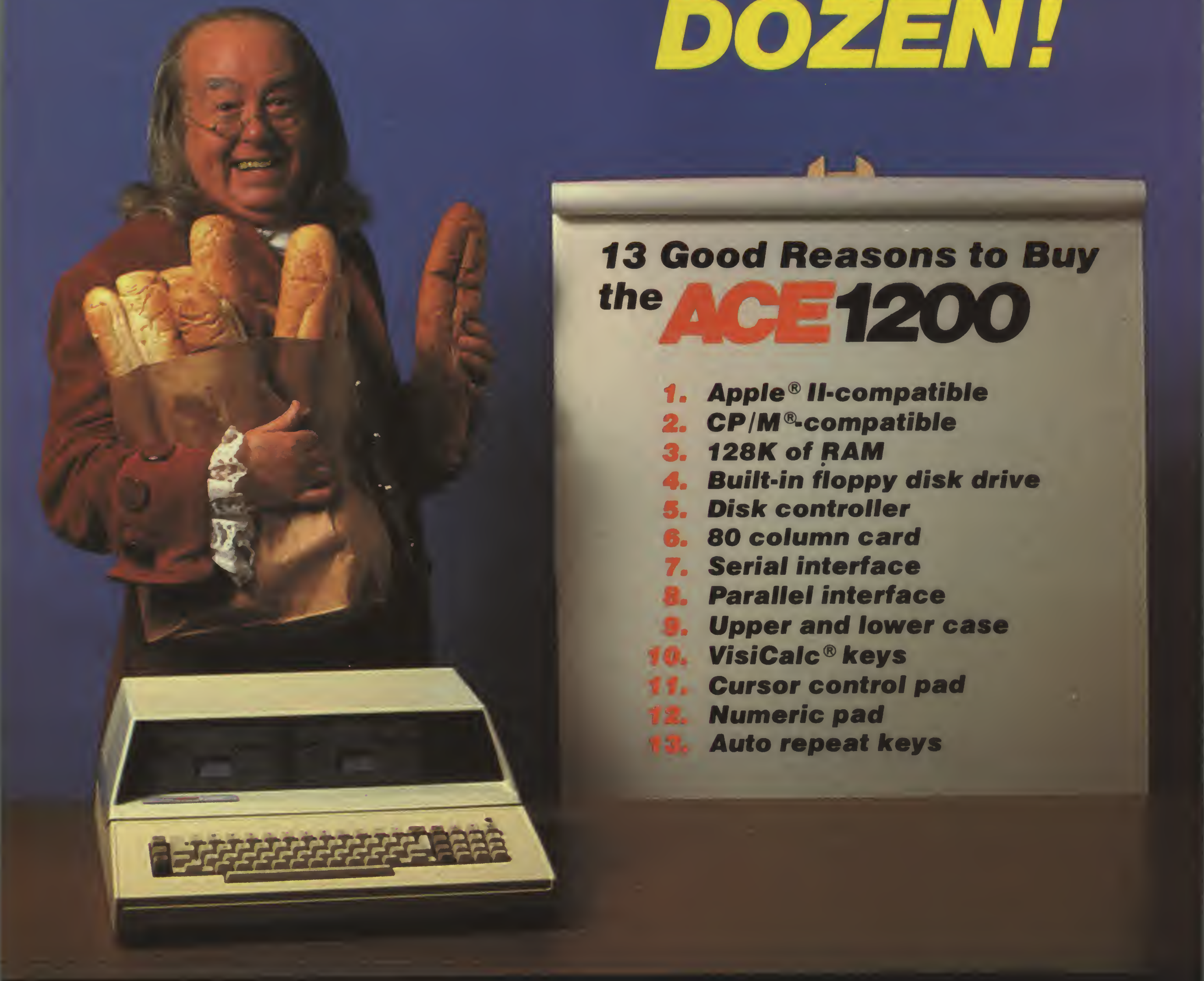

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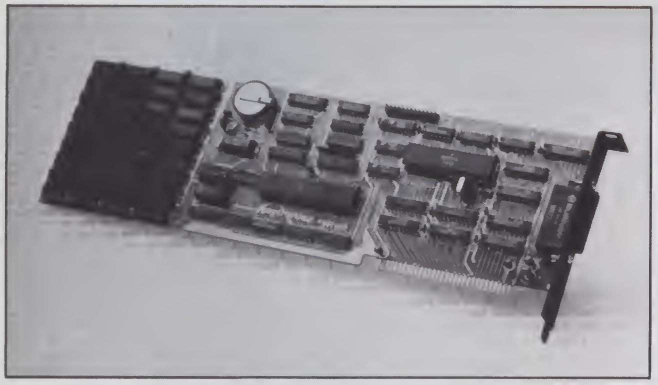


The RAMPlus memory expansion board, from Raytronics, makes a megabyte of memory available on one circuit board.

Mega Memory

The RAMPlus board makes a megabyte memory available for the IBM PC. The RAMPlus board accepts up to four banks of RAM, each bank configured as eight data bits and one parity bit. The memory banks are designed to accept either 64K or 256K RAM chips.

The memory capacity of the RAMPlus board is 256K using 64K RAM chips, and one megabyte with 256K RAM. The 64K chips can be replaced with 256K RAMs when they become available.

Parity error detection logic is contained on the RAMPlus board and can be enabled or disabled with a DIP switch. Other features of the board include serial port, parallel port and clock/calendar with battery backup. Operating software is included with the board.

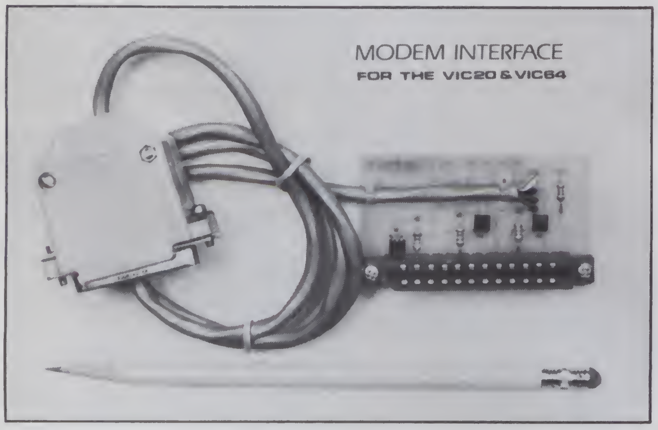
Prices for the RAMPlus board start at $575. For more information, contact Raytronics, 4901 Morena Blvd., Building 900, San Diego, CA 92117. Reader Service number 480.

Commodore-Modem Interface

The Modem Interface allows VIC-20 and Commodore-64 users to connect most modems to their systems. The Modem Interface is compatible with the MicroConnection, Smartmodem, CAT and other modems. A three-foot cable with a standard DB25 connector is supplied with the Modem Interface.

The Modem Interface lets you use your modem's autodial/autoanswer features; included with the Interface is an autodial terminal program.

The Modem Interface costs $21.95, and is available from Bytesize Micro Technology, PO Box 21123, Dept. AZ, Seattle, WA 98111. Reader Service number 492.



The Modem Interface, from Bytesize Micro Technology, allows VIC-20 and Commodore-64 systems to operate with any standard modem.

The Parrot Brings Speech to the TS

The Parrot, from R.I.S.T., Inc. (PO Box 499, Ft. Hamilton Station, Brooklyn, NY 11209), gives the Timex-Sinclair 1000 speech capability.

The plug-in speech module is capable of generating all 64 discrete sounds of the spoken English language. By combining these sounds (allophones) in whatever order you choose, you can generate the words, phrases, sentences and sound effects desired.

The Parrot comes with software that lets you select, string together and pronounce these sounds. Your own programs can also tell the Parrot what to say. Complete instructions and examples are provided in the instruction manual.

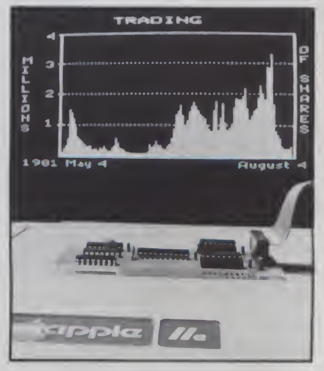
The Parrot module is 3×3×1½ inches and plugs directly into the TS-1000 and ZX-81 computers. It is "piggy-back" compatible, so other modules (e.g., memory and printer) can be plugged in behind the Parrot. An audio output jack is provided for any 4- or 8-ohm speaker, and the module has a volume control. If modules other than the Parrot are being used, a power-input jack for expanded system operation permits the additional power needed. The Parrot costs $89.95. Reader Service number 491.

The Parrot, from R.I.S.T. (Research In Speech Technology), Inc., provides the Timex-Sinclair 1000 with speech capability.

The Apple-Parallel Printer Connection

SSM Microcomputer Products, Inc. (2190 Paragon Drive, San Jose, CA 95131), has released the APPIC/G, a parallel interface for the Apple II and Apple IIe computers. The APPIC/G package contains an APPIC interface card, cable and Graph-It, a graphics software package.

The APPIC parallel interface works with any standard parallel printer. Graph-It, a complete graphics dump program, lets you do a screen dump to any of the following printers: Apple Dot Matrix,



The APPIC/G parallel printer interface, from SSM Microcomputer Products, Inc., lets you use your Apple with any standard parallel printer.

FLEX - OS-9 LEVEL ONE - UNIFLEX - OS-9 LEVEL TWO

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The 2MHz GIMIX 6809 PLUS CPU board includes a time of day clock with battery back-up and 6840 programmable timer to provide the programmer with convenient, accurate time reference. Later addition of 9511 or 9512 arithmetic processors is provided for on the board. The unique **GIMIX** design enables software selection of either OS-9 or FLEX, both included in many complete **GIMIX** systems.

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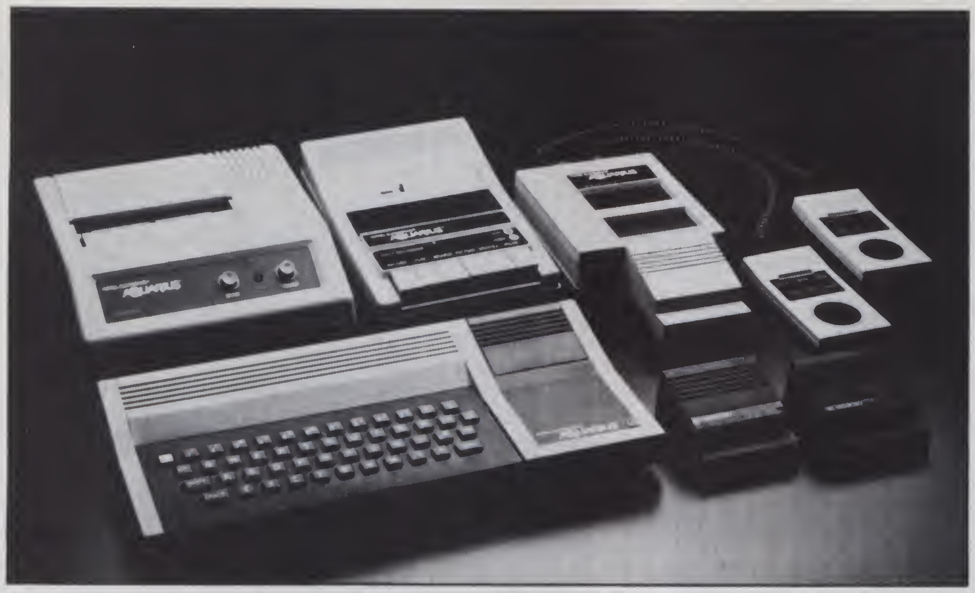

The Aquarius Home Computer System, from Mattel Electronics, Inc., is designed to meet the practical and recreational needs of the home user.

Okidata, Anadex, MPI, Silentype, C. Itoh, IDS, Epson, Centronics, NEC and Trendcom.

With APPIC/G you do not need to purchase additional firmware to support different printers—simply choose your printer from a menu, and print.

With the Graph-It software, you can print graphs, charts, equations, grids, logos, titles and any hi-res Apple graphics.

The interface works under CP/M and Pascal, and maintains compatibility with existing Apple software. Additional cables are available from SSM for nonstandard parallel printers.

The APPIC/G package costs $129. Reader Service number 481.

The Age of Aquarius

The Mattel Electronics' (A Division of Mattel, Inc., 5150 Rosecrans Ave., Hawthorne, CA 90250) Aquarius Home Computer is designed to be a compact, reasonably priced, and easy-to-operate modular system which will expand with your needs.

The entire Aquarius system includes the basic 13 × 6-inch, 49-digit keyboard unit; a thermal printer; a data recorder for program storage and a mini expander with hand controllers to enhance game play. A master expander module, which will let you add up to eight more peripherals to the overall system, will be available later this year (subject to FCC rules and certification).

The basic Aquarius unit features 256 graphics characters as well as 16 colors. It has a built-in 4K capacity, but has a variety of expanders available that will permit an eventual 52K capacity.

Microsoft Basic is built into the Aquarius system, and it uses specially-designed Logo cartridges to instruct children and other first-time users in the use of the computer.

The basic unit will retail for less than $200. The entire system will cost less than $500. Reader Service number 482.

Eight-Pen Plotter

California Computer Products, Inc. (2411 West La Palma Ave., Anaheim, CA 92801), has released an eight-pen desktop plotter that is designed to produce high-resolution charts, graphs, and drawings on paper or overhead transparency film.

The Model 84 plotter will plot on either 8½ × 11-inch (ANSI A) or 287 × 200mm (DIN A4) paper in up to ten colors.

The Model 84 will plot in liquid ink, nylon tip or ceramicron-tipped pen, according to the demands of the application. A special business graphics ROM that allows the user to plot bar, circular or line graphs from simple commands, is also available. Any drawing or graph can be produced on a transparency for use with an overhead projector.

The average plot speed of the Model 84 is 16½ inches per second. The plotter is based on the Z-80 microprocessor and has built-in firmware commands, including five line styles, selectable character rotations, special symbols, six different character sets, viewporting/windowing, scaling and circle/arc generation.

The Model 84's print mode enables you to verify the plotter's configuration when in self-test mode and to print out plot commands.

The plotter has three interchangeable interfaces (RS-232C, IEEE 488 or Centronics parallel), which allow it to be used with most micros, minis or mainframes.

The Model 84 costs $1995. Reader Service number 483.

The Model 84 Plotter, from California Computer Products, plots in up to ten colors on virtually any micro, mini or mainframe computer.

The Birth of PUPS

Bits Power Systems, Inc. (11020 Audelia Road, Suite B114, Dallas, TX 75243), has announced the birth of PUPS (Portable Uninterruptible Power System).

The portable energy system provides complete isolation from the ac power line, and its rechargeable gel cell batteries with integrated electronics provide regulated power to almost any portable computer.

PUPS will power most PCs for four hours (stand-alone, operating on batteries), while it will operate continuously when plugged into an ac wall socket.

PUPS measures 13½ × 8¾ × 3 inches. It is housed in a blue anodized case. A seven state LED battery monitor gives the user an instant and continuous visual indication of the battery energy level during operation and recharge periods. The unit functions as a UPS (Uninterruptible Power Supply), battery pack, surge

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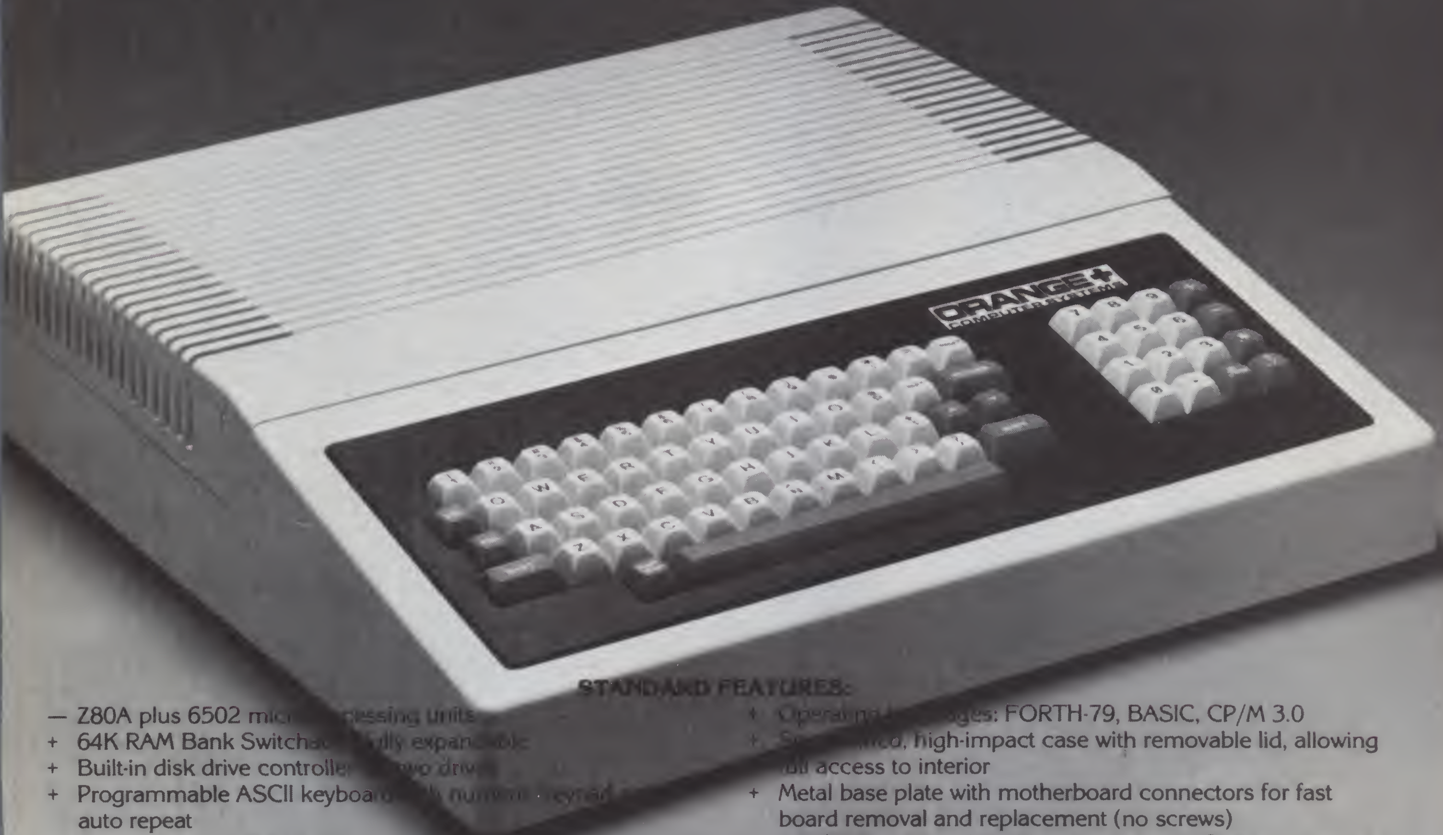

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Inmac's Auto-T-Switch lets you control any peripheral device connected to a CPU. The switch communicates with you via the terminal, and is activated by a simple keyboard entry.

protector and cooling fan—and it's totally portable.

The Osborne-compatible version of PUPS costs $425. Another version which will operate on most other computers is available for $475. Reader Service number 487.

Making the Switch

Auto-T-Switch is designed to let word processor, computer terminal and printer users operate any peripheral device connected to a CPU without leaving the workstation. The switch channels up to four smart or dumb terminals; each connects from a single port.

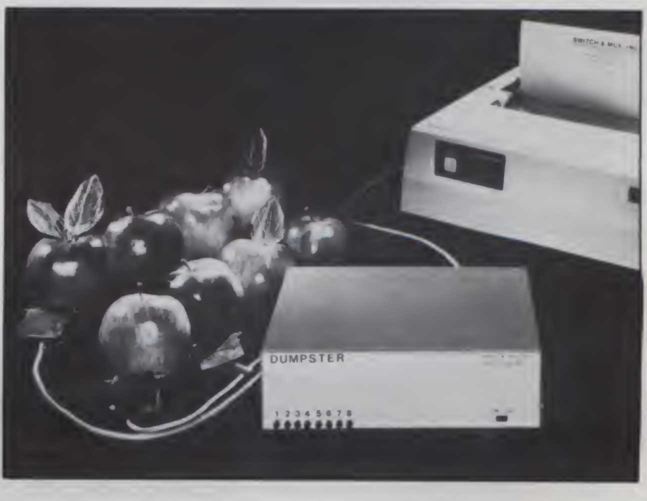
The switch is activated by keyboard entry and will establish on-line priorities when ports are busy, and then notify the user with a beep and CRT display when the line is free. You can nullify previous port positions to transmit through any other port by pressing the reset button.

Operating at baud rates ranging from 110 to 9600, the switch is used with asynchronous data communications systems in a standard RS-232 configuration. The device functions with serial data ports, and utilizes 115V ac, 60Hz and one-half amp maximum power.

The Auto-T-Switch is manufactured by Inmac, 2465 Augustine Drive, Santa Clara, CA 95051. The product's price ranges from $395 to $425, depending upon configuration. Reader Service number 484.

The Dumpster

The Dumpster is a terminal connecting device that automatically links up to eight intelligent terminals or personal computers, including the Apple, TRS-80 and IBM Personal



The Dumpster, from Switch & Mux, Inc., is a terminal connecting device that automatically links several computers to a single serial printer.

Anadex's improved DP-9625A multimode printer.

Computer, to a serial printer.

The Dumpster is designed to be easy to install and maintain, and to save additional printer costs while eliminating hand carrying and manual cable switching.

Utilizing a multiplexing technique for printer capability, the Dumpster handles either positive or negative busy signals and does not rely on data rates or other serial signals—such as parity, start or stop bits or data-bit quantities. A four-wire cable with a maximum length of 500 feet is used for connection.

The Dumpster costs $695 and is available from Switch & Mux, Inc., 10 Oakridge Ave., Merrimack, NH 03054. Reader Service number 488.

New and Improved

Anadex (9825 De Soto Ave., Chatsworth, CA 91311) has announced a new and improved version of its DP-9625A multimode printer.

The DP-9625A is designed to provide both single- and double-pass printing to achieve near letter quality, as well as correspondence, condensed and data processing quality. Graphics capability is standard at either 72 or 144 dots in both the horizontal and vertical dimensions.

The DP-9625A's NLQ (near letter quality) modes include 60 cps at 12 cpi and 50-60 cps with proportional spacing.

The DP-9625A also features Swedish, Danish-Norwegian, German, French, Spanish and Italian character sets in addition to standard USASCII; left, right and full justification; title centering; positive half-line feed; in-line font changes; and RAM expandable to 12.5 in 4K increments.

The printer costs $1995. Reader Service number 489.

A Mini-Printer

The EUY-3T is a miniaturized thermal printer from the Electronic Components Division of Panasonic Industrial Company (One Panasonic Way, Secaucus, NJ 07094).

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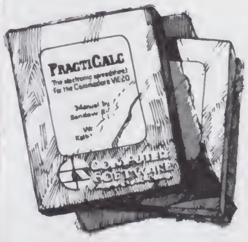

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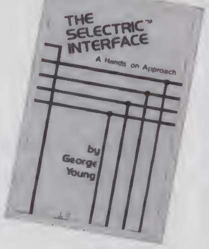

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The SystemCard is manufactured by Microsoft Corp., 10700 Northup Way, Bellevue, WA 98004. The 64K version of the SystemCard costs $475. The 256K version costs $995. Reader Service number 485.

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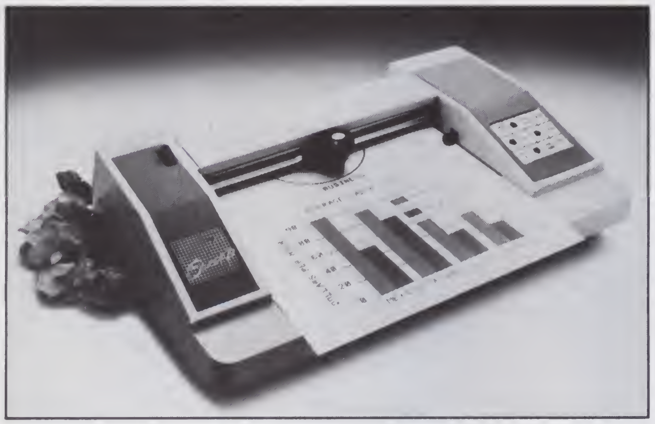
The Model-100 Sweet-P plotter comes complete with computer interface, drawing media and pens—plus a tutorial disk and manual to instruct in operation and programming. It costs $795. It is manufactured by Enter Computer, Inc., 6867 Nancy Ridge Drive, San Diego, CA 92121. Reader Service number 490.



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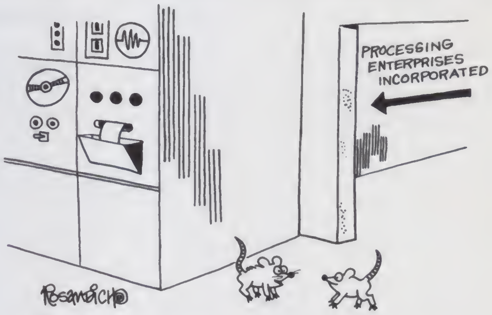

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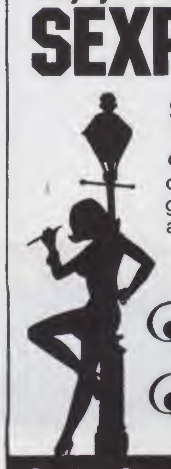

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INSTANT POWER

(From p. 146)

tabular listings.

A second program, Pathfinder Predict, generates a somewhat different set of data. By leaving the task of detailing each suborbital point to Pathfinder II, this module provides speedy access to equatorial crossing data for all future orbits, just those orbits that will be accessible, or the first (reference) orbit for each day. Through the use of an "exclusive" algorithm, Pathfinder Predict provides acquisition and loss of signal times, total time the satellite is in range, maximum elevation, range at the closest point of approach and the time of closest point of approach.

Pathfinder II is easy to use. At first I dispensed with reading the manual and relied on the screen prompts to guide me through the program's operation. In a matter of minutes, I was displaying the orbital data for that day's passes of OSCAR 8 (Orbital Satellite Carrying Amateur Radio). Once I had my fill of working with known data, I tried creating my own satellites, finding Pathfinder II's graphics a good way to play what-if games with orbital mechanics.

The sophistication of Pathfinder II's graphics displays is not to be taken lightly, but I didn't see the usefulness of real-time feedback.

Pathfinder II's finery is great for less hectic times, but I'd prefer to stick to a simple printout during the busy moments when a satellite is within range. Other users must agree, since Pathfinder II also provides for printouts that include only the essential data.

To the best of my knowledge, Pathfinder II performs as advertised. Lacking an Epson printer, I didn't get a chance to try the screen dump utility. I did manage to simulate it with a Grappler interface board and NEC8023 printer. Although it can't be labeled a bug, certain portions of printed data tables came out in double-size type. I've experienced the same problem with other software, and I speculate that it results from an unusual control code tripping up my printer. Luckily, most of the Pathfinder software is written in Basic, making it easy for a knowledgeable user to customize.

At times Pathfinder II appears to be working at a snail's pace. Using data from mid-1982 to calculate the orbits for March 1, 1983, took almost two minutes. Admittedly, a serious user would use a more current set of base numbers. Another test, this one using NASA-supplied values for February 1983, reduced the calculation time to under 10 seconds. Frequent updates solve only part of the problem, though. Calculating suborbital points is another slowdown, with Pathfinder II taking just over three minutes to figure data at 120 intervals (the maximum allowed) during a satellite's orbit. Replacing the Applesoft Basic code with machine language algorithms is the obvious solution. However, if you're like most people, even the "snail's pace" of a Basic program will seem speedy when compared to the time required to do the same calculations by hand.

Error handling comes in two forms. First, the program rarely accepts bad inputs, but if it does encounter a fatal blunder, it probably won't crash. While the overall operation of Pathfinder II could be described with the tired phrase "user-friendly," I did find it difficult to change key constraints midway through a session. For example, once you choose a specific number of suborbital points, you are locked in unless you start over. On the other hand, I found it annoying to have to enter the longitude and latitude of my location every time I booted the program. It would have been nice to include a default option for this relatively permanent data.

> Pathfinder II was
> born to fill a need.
> In evolving from a
> hobbyist's project into
> a commercial package, it . . .
> may enjoy a golden future.

Given the program's price, $34.95, Pathfinder II's documentation is surprisingly good. Housed in a 7 × 9 inch vinyl binder are 39 pages giving step-by-step operating instructions, an appendix on satellite tracking basics, details on obtaining orbital parameters from NASA, and a good glossary.

Pathfinder II was born to fill a need. In evolving from a hobbyist's project into a commercial package, it has kept to the original premise: assistance for individuals who track amateur radio satellites. While it might be considered an unpretentious piece of specialty software today, Pathfinder II may enjoy a golden future. Plans are being made to build and launch PACSAT, an amateur satellite dubbed the "flying mailbox." Designed to handle digital communications, PACSAT might result in a future Chicken Little's consulting Pathfinder II and then running into the street shouting, "The mail is coming, the mail is coming." *(Computer Applications, 3628 A Court, Oxnard, CA 93033. $34.95)*

Tim Daniel
Oxford, OH

Quick Brown Fox

A word processor
That will grow
With your VIC

Quick Brown Fox (QBF) is a word processor for the expanded or unexpanded VIC-20. *Stop!* Do not run screaming from the room because of the VIC's 22-column screen. You may well need that screen (I'll explain later), and you can expand the system in many ways, including screen size.

What you *do* get with this word processor on the VIC is a full tactile keyboard, a system you could keep in a submarine, and a printed output that looks expensive.

Picture This

Scenario: Father talks to son: "I want to help you make good when you go to school, kid, so here's $70. It's all I could scrape up above the other costs." Kid: "Pop, that's gonna get me a VIC/QBF word processor."

What CRT is the kid going to use in his cubicle-sized apartment? The old TV, of course. No room or money for anything else. Have you ever seen 40 columns on an old TV? It's not readable. When he can afford a monitor, that's the time to get fussy about the number of columns on the screen.

Beginners are going to be interested in this system. An experienced user is already convinced that the system he knows how to operate is the best there is.

Word processors are designed to allow for the storage, retrieval, editing and formatting of text before it is printed. As the system gets more elaborate, the user is given more options, such as automatic page numbering, page titles, a standard phrase library, and print format options including margins, lines per page, keyboard insertions, multiple copies and partial text printing. QBF has all of these features.

There are, however, two things that QBF does not have. Formatted output cannot be shown on the screen prior to printing without a wide-screen add-on; this means that you will have to run trial printer outputs more often in order to verify formatting. Also, the VIC screen editor is not implemented, but more on this later.

Earlier, I mentioned the ability to expand the system. It will run cassette records and disk records interchangeably. You can start with cassette, and convert smoothly to disk later.

QBF itself is all in a module that plugs into the memory expansion port of a bare VIC. It is not in user RAM and only needs about 1500 bytes of RAM for workspace and Input/Output. You get the other 2000 spaces to write in. You do not have to load it in; just turn it on.

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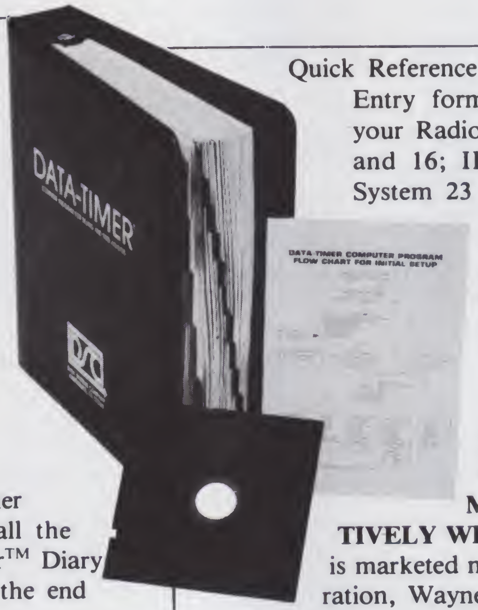

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Plug in a 16K expander (you will need a motherboard) and you have 18K to write in, a lot more than many higher-priced systems. However, you are limited in a single document to your memory size, as files do not link together. Commodore or ASCII printers can be used.

For New Users

The QBF book is appropriately written for the user who is new to word processing. I would like to have seen some of the reassuring words given in this manual when I was first exposed to this arcane art. Some manuals are in despair about where to start. This manual takes a revolutionary tack—it starts at the beginning.

I found it easy to follow. I especially liked the way the author finished up the section on printer codes that may ". . . drive your terminal or screen completely bananas. The next time that someone asks you to sign a petition for standardization in control code sequences," he continued, "please sign it." Simply yet eloquently stated.

Another QBF idea that I believe is simple yet eloquent is the concept of the "file clerk" with his sub-menu for handling record storage. This is way ahead of any other file option.

Editing Capabilities

The fact that this is a low-cost start-up system with expansion capability and expensive-looking output is the main selling point of QBF. Virtually no one could tell that this nice output came from a little VIC. That's the good news. The not-so-good news is that there is an upper limit to the expandability. Certain features are not going to be there even when the system is fully implemented.

The most important of these is screen editing. When you are composing text, the use of delete, replace and insert is the grease that lubricates the creative process of editing. QBF has all of these functions, but they are line oriented.

What's the Difference?

Screen editing allows the user to act directly on the text as displayed on the screen. With a screen editor, you will move the cursor directly to the position where changes are desired, anywhere on the screen, then enter the delete, replace or insert mode and make changes in the text right there.

A line editor, however, will move the line of interest to the bottom of the screen, so you will be required to act upon words and phrases that are moved from the sentence you were working on. You have to be more organized to operate a line editor efficiently. Paper and pencil are sometimes helpful for larger edits. Practice will blur this distinction, and, in the final analysis, the best editor is the one you know.

Edit Functions

The QBF editor allows you to define characters anywhere in text, and you can move blocks of text of any size either as a move or a replicate. Most of the commands only require a single keystroke. You are not often required to hold down the control or the escape key and then press another. This two-handed operation is often required with some popular larger systems.

General Information

The screen comes up white on black. This is one of the best combinations for a black-and-white TV, but it can create problems in the corners if connected to a color set. The large characters help. A 40- or 80-character output (optional add-on hardware) will simply require a higher-quality display.

The QBF system supports Global edits, certain modem communications, page headers, and commands embedded in text that redefine paragraphs, lines per page, double or triple space, margin resets, justification and centering. You can send special (control) characters to the printer anytime.

The Problems of Printing

Possibly the most perplexing problem encountered by VIC owners is that of

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properly connecting a printer to the machine. There is more than one way to connect a printer to the VIC, and some methods work better than others.

My recommendation is to buy your printer and your interface at the same place—after they have been demonstrated to work, preferably on *your* VIC. If the printer will list correctly, it's probably OK, but a QBF output would be ideal.

Every few months someone comes out with a more intelligent printer. Soon printers will be smart enough to stop printing if the phrase "user-friendly" is sent to them. In the meantime, the codes that operate these printers are not identical.

QBF handles this dilemma better than most. If the internal codes that have been set up to invoke printer functions won't work, any code between 0 and 255 can be sent out; this is sure to work. Some current editions of expensive word processors cannot equal this versatility.

When you go to print, you will find some nice features: You can start from any point you specify in text. You can feed single sheets. Automatic page numbering can include a chapter designation if you wish. Printing will stop to fill in a salutation or name from the keyboard. You just tell it where.

Conditional paging, a feature that ensures that a certain number of lines are printed together, exists in QBF as an AP function, where paragraphs are forced together if at all possible.

Conclusion

If you have been using a typewriter and are now venturing modestly into word processing, Quick Brown Fox will give you good-looking results right away, and it is designed to grow with your VIC system. *(Quick Brown Fox, 548 Broadway, Suite 4F, New York, NY 10012. $65)*

Ron Gunn
Livermore, CA

Quotrix

A challenging
Word game
For the IBM PC

If you have an IBM Personal Computer and you're a fan of crossword puzzles, anagrams, jumbled words, fuzzy clues, trivia, foreign words, old-time movies, rock music, books and authors, geography, history, monographs, and outright intellectual madness, you must purchase Quotrix, by Insoft. A word of warning—you *must* know something about all these things if you hope to finish with a worthwhile score.

Quotrix exercises the mind. After a day of spreadsheets, accounts receivable and trend plotting, Quotrix combines features of the New York Times Crossword Puzzle, your fourth grade geography and seventh grade history lessons (you *thought* were behind you), and enough of a mixture of contemporary and ancient trivia to thoroughly challenge you.

Quotrix asks you to decipher quotations from people you know, people you remember and people you probably never heard of before. Gershwin I can handle, but Schopenhauer is hardly a household word. Moliere I had read, but Rochefoucauld was a new one on me. If you know (or can guess) the selected word of the quotation (and you have the ability to move around within the quotation itself), then you may proceed.

If you don't know it, you are given the opportunity to figure it out, either by letter (and an incorrect guess adds to the load on the camel's back) or by word (using a crossword type of investigation).

If Quotrix offers you the letter route, you may select by letter until either you have figured out the word or you have added so much to the camel's load that you break his back. If it offers you the crossword, then you have the opportunity to complete the crossword using a baker's dozen of categories, including state/country capitals, movie actors/actresses, Spanish/French words, U.S. Presidents, inventors and so on.

You are being scored all the time; part of the time you work against the clock. In one of the exercises, you must unscramble words. As quickly as you can unscramble a word, you are scored and the game progresses. In this particular area you must study what you must do mechanically. Once you have it, the process is easy. As the game progresses, there is fun, excitement and even a little panic.

To liven things up a little bit, Quotrix offers you six levels of play: master, expert, competent, capable, trainee and beginner. It assumes that you have some capability at the outset, and sets you at the "capable" level to begin. Finding that I wasn't quite "capable," I moved from there, where my quote was eight words, to "beginner," where it was (shudder) 14! By and large, the differences between the categories have to do with the number of guesses you are allowed and the time in which you must complete your tasks.

For the first few times around, you'll feel a little short of even the beginner level. After that, as you gain skill and find that you don't panic at the request for knowledge you've long since buried, it becomes a super intellectual challenge. You may learn the game thoroughly in a year or two. But until then, you will walk a mile for that camel. And you can quote me; no tricks. *(Insoft, Inc., 10175 S.W. Barbur Blvd., Suite 202B, Portland, OR 97219. $34.95.)*

Ken Lord
Winchendon, MA

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SOFTWARE REVIEWS

Edited by Dan Muse

Evolution – Darwin Would've Loved This Game

Tracking the Satellite of Your Choice

A Feature-Packed VIC-20 Word Processor

A Game For People With a Love For Words

Evolution

Can you evolve
From bacteria to bug
To human being?

Evolution was billed as an "incredible new progressive" game, with press announcements proclaiming fantastic acceptance, so naturally I could hardly wait to try this game on my Apple.

To play Evolution you need an Apple equipped with 48K of memory and a disk drive. You can use a joystick or the keyboard to control action. My personal preference for this game is both . . . some sections work better with the joystick and others work better with the keyboard. Fortunately, this can be switched during the game, so cake can be had and eaten too; this brings us to how the game works.

Most of you are aware of how we came about—scientifically, that is. First there were microscopic germs, bugs, reptiles, mammals, then us, right? The order isn't too important, but this is the concept.

Evolution is a game of life where you start out as an amoeba with five lives. If you manage to eat all the amoeba food, and the hungry (and mean) bacteria don't get you, evolution takes place and you come back as a frog.

As a frog you must eat three bugs and avoid fish who are intent on eating your remaining lives. If you succeed, you evolve into a rat. Next, you take the persona of a beaver trying to build a dam from sticks. Danger lurks on the other side of the water—alligator-infested water that is.

Then, if you survive, you become a gorilla who throws coconuts at monkeys. Finally you evolve into a human. If the human survives—heh, heh—an atomic explosion wipes him out and it starts all over, this time with tougher, meaner bacteria.

The game is generally good. Both my kid game testers and I found it enjoyable. The music is OK, but becomes a drag after a while. (Each evolutionary stage is brought in with a musical fanfare which has to be manually turned off after each pass.)

I've mentioned this problem before . . . game people must let us play the game again quickly, and stay out of the way during restarts. Cute music and scenery is nice when showing games off to a disapproving wife, but they are a painful drag later. There is a lot of slow fanfare and music during initialization, probably 30 seconds or more, that cannot be turned off or shortened.

Evolution's animation is generally well-done. Personally, my favorite life is the frog, which lives on the bottom of a pond. The frog arrives in a cloud of bubbles that slowly parts as it descends to the bottom of the screen. A couple of water shrubs gently wave in the current, and an occasional water bug cruises by. And the fish—those lousy fish—slowly swim about, lower and lower. Since the frog can only move left and right, plus hop, the game becomes one of avoidance, plus you really want to get three of the bugs. This presents some real problems.

This is a good game to get or give for a birthday gift, and I think most people will enjoy it and envy the two Canadian authors. . . Jeff Sember is 16, but Don Mattrick is much older . . . he's 18. (*Sydney Development Corporation, 600-1385 West 8th Ave., Vancouver, B.C., Canada V6H 3V9 $39.95*)

Jim Hansen
New Boston, NH

Pathfinder II

With this program
And an Apple II, you
Can track any satellite

Instead of crying, "The sky is falling, the sky is falling," a modern-day Chicken Little might admonish us to head for cover because a satellite is falling. But for every newsmaking geriatric orbiter's fiery reentry, there are dozens of other "birds" that continue to blissfully circle the earth. Enter Pathfinder II, a software package from Computer Applications, designed to assist in the location and tracking of satellites.

Admittedly, Pathfinder II will find a small audience. It is aimed primarily at radio amateurs who use several satellites that act as relay stations. But given the proper data, Pathfinder II will track any satellite with a circular orbit; this includes weather satellites like NOAA 7.

Besides a satellite that needs to be tracked, you'll have to have an Apple II with 48K, Applesoft Basic and one disk drive. Optional, but strongly recommended, is an Epson MX-80 or MX-100 printer.

The bulk of the package's features are incorporated in a program appropriately called Pathfinder II. Here information is calculated about the satellite's horizon, precession (degrees of earth rotation during one orbit), number of orbits per day, the orbit numbers and equatorial crossing data. With these numbers stored away, the user selects an orbit to be tracked and the number of subsatellite points to be calculated. Longitude, latitude, distance and a bearing are returned for each point, and the program determines if the satellite will be visible to the tracking station and gives the elevation angle at which it will appear.

At this point, Pathfinder II diverges from the humdrum business of crunching numbers, and offers several unique ways to view the data. Real-time track draws a map of the world or the United States and superimposes the actual position of the satellite, providing the current position, time and antenna pointing data. Users equipped with the proper printer will be able to make a paper copy of these images. If you prefer numbers over graphics, you can select one of several

(Continued on p. 142)

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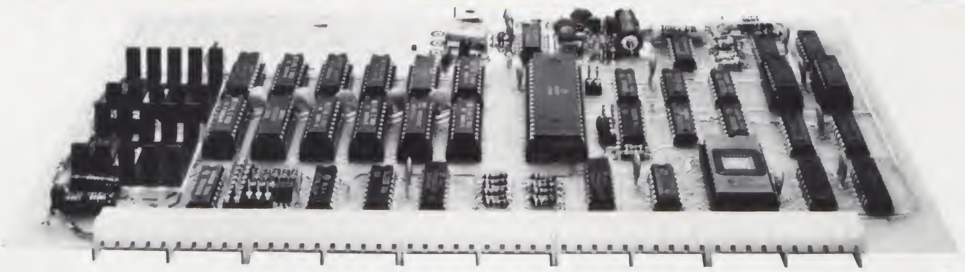

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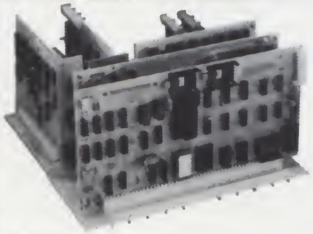

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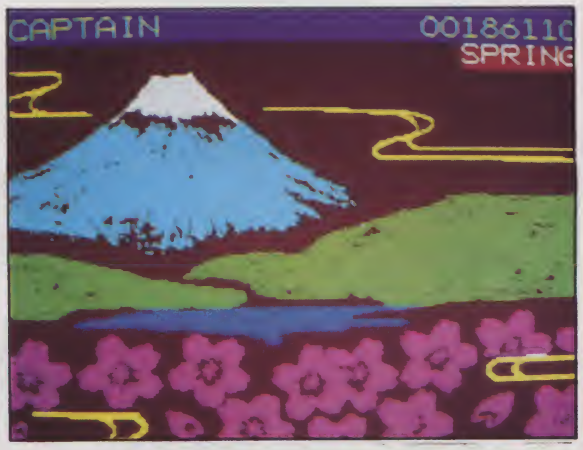

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This month:

The editorial staff of *Kilobaud Microcomputing* receives many requests for copies of the magazine's editorial calendar. Public relations firms, advertisers and manufacturers—to help plan their promotional activities for the upcoming year—are naturally anxious to receive copies of our editorial schedule. Our writers, too, need to coordinate their writing efforts with the special issues scheduled.

Since, for the most part, *Kilobaud Microcomputing* is written by its readers, we are publishing a list of some of the major topics to be covered during the coming year. Please note that this schedule is subject to change. Editorial material should be received by the 25th of the month three months prior to the date of publication (e.g., Oct. 25 for the January issue).

So, at the risk of tipping our hand and revealing our strategy to the competition, we include the following editorial calendar to help you plan your writing schedule for the coming year. Choose a topic and start writing.

December—A look at the microcomputers recently released by IBM and Xerox
January—Micros used in scientific applications
February—Languages
March—Artificial intelligence
April—16-bit microprocessors
May—Local networking
June—Computer crime
July—Speech synthesis
August—Micros in business
September—Education
October—Hardware construction projects
November—Micros as appropriate technology (e.g., alternative energy systems and humanistic applications).

—The Editors

This month's cover:

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EDITORS' NOTES

Medical Breakthrough

Doctors Computerize Practice

Health Care and the Microcomputer

We are all only beginning to discover the real power of the microcomputer. Here I am not referring to computing power, though that continues to grow with no end in sight—machines can be picked up at a local computer store with 256K bytes of memory on board, 16-bit processors are already a fact of daily life (32-bit processors can't be far around the next bend) and hard-disk drives have arrived. As impressive as the relentless growth of computing power is, the real power of the microcomputer lies in its versatility as a tool for man—the easy way in which that computing power can be remolded into a variety of tools for various applications.

The Proteus Machine

A single microcomputer can appear to be different things to different people—a word processor, a video game unit, a learning aid, a records storage and retrieval system and so on. (The list seems to lengthen daily.) Any one of the popular microcomputers can do any of these things and much more, depending simply on the software being used.

It is this ability to change hats at the insertion of a floppy disk that makes the microcomputer such a powerful tool in many settings. Perhaps nowhere can more of the microcomputer's abilities be used than in the health-care industry. Providers of health-care services (doctors, dentists, clinics, etc.) have a number of problems in common with other professions and small businesses—bookkeeping, billing and calculating employees' salaries, to mention a few. There are a number of fine microcomputer software packages available to help with such tasks. But there are a number of more interesting problems peculiar to the health-care industry.

Medical Networking

Such a network would give a physician immediate indices of the latest medical articles. It could be used to put doctors in contact with one another in new ways. Instead of having to consult a specialist by telephone or in person and mailing or delivering patient records, the necessary information could be transmitted via the network. The specialist would have it immediately, and could review it at his first opportunity, then transmit his recommendations back to the requesting physician. This might not only increase the efficiency of delivering medical care, but also help to decrease the cost of such care.

> Perhaps nowhere can more of the microcomputer's abilities be used than in the health-care industry.

A network of this sort could also give doctors access to expert programs that are being developed by several researchers. Such programs reproduce the special diagnostic skills of medical specialists. These programs collect data on a patient's symptoms, case history, test results and so forth. Acting much like a human diagnostician, the program then decides which possibilities to delve into, asks specific questions about a possible illness and then suggests a diagnosis.

Special Health-Care Problems

Some of these problems have to do with handling several different kinds of insurance forms, maintaining up-to-date appointment schedules and dealing with extensive patient records. Two articles in this issue address this class of problems. There seems to be little commercially-available microcomputer software to aid the health-care professional in this area. But much can be done by modifying existing software, and a number of practitioners (doctors and dentists) who have developed their own software are usually willing to market or in some way share it. If a doctor or dentist wants a computerized office, it is no longer necessary to become (or hire) a programmer to design a special system. And it should be getting easier. (In fact, we hope to keep you aware of what is available and how further information can be obtained.)

There is another group of medically related problems that the microcomputer can also help solve. It is often necessary for a doctor or dentist to seek expert advice on a diagnosis or therapy. Traditionally, this has been handled by either consulting with a specialist or studying medical books and journals.

Computers can aid in this process in a number of ways. A special medical network that physicians could access by using an office microcomputer in a terminal mode (which makes the computer act like a terminal) could put an immense amount of information at their fingertips.

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META NOTATIONS...

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* * *

In a couple of months MTC will introduce the successor to AIDS-III/CALCS. It is called AIDS/P™ and is based on MTC's PRIMAL™ (Practical Relational Information Management Applications Library), a powerful system for PRIME minicomputers. AIDS/P features the best of the critically acclaimed AIDS-III/CALCS but is probably an order of magnitude beyond it in power. It will be first made available to AIDS-III/CALCS owners (for an upgrade charge), then to the general public. Price will be in the $200-$300 range.

* * *

Effective September 1, 1981, Metatronics Corporation became a subsidiary of MTC. Metatronics will carry the complete MTC product line in addition to its own. Order processing and fulfillment departments have been combined to improve service response levels. MTC's superior software and supplies marketing, and Metatronics exceptional peripheral offerings should prove to be a fomidable combination. (Sorry guys, if you can't beat us, join us . . .)

* * *

MTC now offers a more complete selection of diskette products (ad deadlines prevented inclusion in anything but this column). New manufacturers are MAXELL and 3M. Definitely call for specific information. For example, MAXELL Brand 5¼" diskettes in a PLASTIC LIBRARY CASE are only $34.95 for a box of 10! SCOTCH Brand diskettes are comparably value-priced. MTC is also introducing its own PARAGON™ Brand media products. The intent is to offer a super-high quality product at a very competitive price. For example, a box of 10 single-sided, soft-sectored, double-density, 100% certified diskettes with HUB RINGS is only $24.95! A full line of products (including HEAD CLEANING KITS, etc.) will be offered. The PLAIN JANE™ (almost 200,000 units sold) diskette line will become part of the PARAGON™ MAGNETICS operation (but don't quote us verbatim).

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by David Stambaugh

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A physician who had a computerized office could most efficiently make use of such programs via a network. He could transmit the computer-recorded case file of the patient in question to the expert program, possibly answer a few questions and receive a recommended diagnosis from the program.

These are not original ideas. Neither are they futuristic dreams of what might be available some day. The technology for such systems is available today. All we lack is sufficient impetus to put the parts together.

Patient Education

Interactive programs exist which ask for information about the user's lifestyle and habits, then give the user information about possible health hazards and life expectancy. This kind of interactive program, if available in a doctor's or dentist's office, could aid the practitioner in educating patients about specific medical situations. Interactive educational programs would also be a great service to patients and their families, who could obtain accurate, current information when needed.

Monitor and Control Systems

Dedicated microcomputer systems (small systems designed to do one job, but do it continually) have been around for a while and are beginning to appear in health-care environments. These systems may consist of "off the shelf" computers and peripherals or of specially designed inexpensive single-board computers.

Small dedicated systems can be used in hospitals to monitor and record patient "behavior"—brain-wave patterns, chemical levels in the body, etc. They can also be used to monitor and control laboratory tests. The possibilities of using microcomputers in this way are also open-ended and exist right now.

In The Months Ahead

We will continue to bring you more information on work being done with microcomputers in medicine. Articles will range from accounts of small dedicated systems designed for specific control and monitoring tasks in patient care and laboratory test analysis to programs designed to help physicians make fast, accurate diagnoses in problem cases.

Concern is often expressed that health care has become increasingly impersonal. Here, and in following issues, we will look at ways microcomputers can serve our physicians and allow them to provide more efficient patient-oriented health care. We won't be seeing computers replacing our doctors; we will see computers helping them provide more personal medical care.

We have only scratched the surface and introduced the subject in this issue. Since health care is a vital concern to all of us, patient and practitioner, we will regularly look at new medical applications of microcomputers.

Harold Nelson
Technical Editor

SofDoc—A Medical Software Exchange

As physicians begin to develop an appreciation for the potential of the microcomputer, they apply their medical knowledge to the task of producing medical applications software. Many physicians try to market the result of their labors, but find that it is extremely difficult to track down other computing doctors. Enter SofDoc, a microcomputer software exchange.

SofDoc is the creation of Dr. James Gange of Los Angeles, California. Dr. Gange began SofDoc as a way to help some like-minded physician friends who all had some software that they were willing and eager to share with their colleagues. Since its inception about a year ago, SofDoc has been adopted as an official project by the Society for Computer Medicine, whose president is Dr. Marion Ball, the Director of Computer Services at the Temple University Medical School.

> Microcomputers should have a profound impact on the practice of medicine.

SofDoc's current offering is a collection of approximately 25 programs. Included in the package, distributed on a 5¼-inch floppy disk, are:

- programs to evaluate pulmonary function
- programs to set up a respirator
- programs to generate evaluations of lab tests such as glucose tolerance and electrolyte balance
- three programs to evaluate a patient's lifestyle, help the patient figure out why he can't give up smoking and suggest ways to improve health by changing lifestyle habits
- the ANSI standard MUMPS program, the most commonly used medically oriented language

All of these programs are written in various dialects of BASIC (with the exception of MUMPS). The disk is available to physicians for $25. A physician can join SofDoc and receive the software for free by contributing software to the exchange. The programs will run on the Apple II and II Plus.

SofDoc is always on the lookout for new software and is looking for competent software editors and programmers, as well. Dr. Gange says the exchange can't pay editors at present, but can arrange to provide references in return for editing, translating to other BASICs and operating systems and debugging. SofDoc is not interested in business office software; the thrust of SofDoc is clinical application software.

In a recent interview with *Microcomputing*, Dr. Gange said that, theoretically, microcomputers should have a profound impact on the practice of medicine. Practically, however, says Dr. Gange, "This hasn't happened yet. The development of clinical applications is still in the embryonic stage." Dr. Gange speculated that growth in the field had been slowed by the difficulty in distributing medical software. This is one of the reasons he launched SofDoc (it is also one of the chief reasons for choosing this as the theme for this issue of *Microcomputing*).

For further information, write to SofDoc, c/o Dr. James Gange, 1433 Roszmare Road, Los Angeles, CA 90024.

G. Michael Vose
***Microcomputing* staff**

What to Expect From *Microcomputing*

We are probably not the only editorial staff that finds it necessary from time to time to ask ourselves questions like, "Who reads our magazine?"

We find it necessary because it helps us reevaluate whether or not the content and style of *Microcomputing* are appropriate for the people who are, or, in our perception, should be, readers of the magazine. If we don't give our readers information they need and want, they will have little reason to stay with us. All readers want material presented in a clear, readable style. Of course, what is readable for a student, a small-business person, an engineer and a Ph.D. in one of the humanities will not be the same, in most cases.

Style

Most publications would consider these individuals to represent four distinct audiences. For *Microcomputing* that is generally not the case. We do not view our readers as having reached some specific academic or professional level. We obviously see our readers as having a common interest in the area of personal computing. But we also view our readers as having attained various levels of sophistication in that area. This presents some unique problems.

Some of our material is directed toward the beginning computerist—whether a twelve-year-old student or a corporate executive. This material is aimed at the individual who has access (in the home, school or office) to a microcomputer but who has little experience working with computers.

Other material presupposes some computing expertise on the part of the reader. This material is aimed at the individual who owns a microcomputer and knows what to do with it—at least for certain applications. Individuals of this sort, also, come in a variety of ages and from a variety of backgrounds.

How do we go about presenting material to readers of differing educational and professional backgrounds whose only common interest is microcomputing?

We do it, first, by striving for clarity. We don't think you should have to spend time trying to figure out what an article means. Also, we think it should be apparent from the beginning whether or not the subject of an article will be of interest to you and appropriate for your level of experience.

We will be working harder than ever to cut through the computer jargon that has grown up around the microcomputing industry. While much of this terminology serves as a kind of shorthand, most of it is confusing to the beginner. For example, a term like *baud*, which is a holdover from the prehistory of microcomputing, does not tell the neophyte that we are talking about the rate of serial data transfer. In fact, if he looks up baud in a technical dictionary, he is likely to find statements about units of modulation speed or the number of signal line changes per second. We have decided, following the example of other computing publications, to use more descriptive terms like *data rate* and *bits per second* in discussions of data transmission (which is what baud is generally used to mean anyway).

Other terms can be actually misleading. The term *RAM*, for example, is usually used as the opposite of ROM. In fact, RAM (which stands for random-access memory) is not the opposite of ROM (read-only memory), since almost all ROM used in microcomputers is random-access memory. The real distinction is that one type of memory can be programmed and reprogrammed from the keyboard by the user and the other has its program "burned" into it and cannot be reprogrammed from the keyboard (it can only be read).

Since these terms are so widely used, we have decided to continue using them but to remind the reader from time to time that when he sees RAM he should think *programmable random-access memory*. In fact, this represents the general way in which we will handle computer jargon and technical terminology. We will occasionally remind the reader what such terms are used to mean in microcomputing circles. This will introduce beginners to terms that they will encounter when dealing with other computerists, and, at the same time, will preserve the shorthand value of such terms.

Content

Another problem presented by what we believe should be our varied audience is that of article content. The material we present should cover the range of what is appropriate to the beginner to what is of interest and value to the moderately sophisticated computer user. And this range must be covered in a variety of areas—programs and programming, constructions and modifications, new applications, product reviews and so on.

How then do we choose material for *Microcomputing*?

A number of factors determine our choice of material for publication. Subject matter should appeal to as wide an audience as possible. While not all articles will be of equal value to all of our readers, we try to present articles in such a way that they will all be of interest to as many of our readers as possible. Of course, some beginners will not be able to follow all construction projects or advanced programming articles. (Hopefully, these readers will recognize some significance in such articles and save them for future use.) Other readers may not feel a need for some elementary tutorial articles. (But a certain amount of review is always beneficial, and these readers are often the providers and critics of our tutorial material, thus helping to keep us all up to date.)

There is and will be a good deal more consumer-oriented material than in the past.

We want the information we offer you—whether it is about people or events in the microcomputing industry, products, applications or hardware modifications—to be as current as possible. At the same time, we will occasionally bring you information on new applications or updating modifications for older equipment provided that the equipment is still readily available to our readers.

Microcomputers and computing have undergone quite an evolution in a very few years. Microcomputing has gone from a hardware-hackers hobby to a major consumer industry (and from all indications—IBM and Xerox have just joined the field—we are still at the very beginning). Accordingly, as many long-time readers have correctly observed, *Microcomputing* is also changing and growing. There is and will be a good deal more consumer-oriented material than in the past—reviews of new computers, peripherals, software and publications, for example. There will continue to be articles on new and interesting ways of using microcomputers. And you can expect to still find a good number of useful and just plain fun program listings in *Microcomputing*. We will, as always, be publishing quality articles on hardware construction and modification projects. There will, however, be some changes in the hardware articles we will be offering from those we offered in the past, again reflecting the changes in the field. Our criteria for hardware articles now include the following considerations:

- The material should be useful to a large number of readers.
- Components used should be readily available.
- They should offer something that is not commercially available or something that is commercially available but only at a much higher price than the costs incurred in the project.

We know our hardware articles have been useful to our readers in the past and we hope they will be even more so in the future.

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Almost everyone who is involved with microcomputers—from the rank beginner on up—should read *Microcomputing*. We like to think that reading our magazine should be an education. It should help you get started and help you grow in sophistication as a microcomputer user. If you are an electrical engineer or computer scientist, you may not need us; otherwise, you almost certainly do need us.

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There is a great deal happening in our field and we want to help keep you informed and up to date. We also would like to hear from you. Let us know what you like and dislike about the magazine, what you would like us to review and the kinds of articles you would like to see. This can only help us to serve you better.

Harold Nelson,
Technical Editor.

PET-POURRI

By Robert W. Baker

Word Pro Enhancement

Lets You Print Source Files

Word Pro File Printer

I put together this little program a few days ago (Listing 1). Its sole purpose is to print a Word Pro source file, something you currently cannot do with Word Pro itself. Word Pro only lets you print the formatted output; you can only save and restore source files to disk.

A nice side-benefit of this program is that you don't have to load Word Pro just to look at a few files. This avoids the inconvenience of having to kill Word Pro to reset the system.

```
10 REM WORD PRO SOURCE FILE PRINTER
15 REM
18 REM       BY: ROBERT BAKER
20 REM
25 :
30 LN=40: LM=20: DR$="0:"
32 :
33 REM SET LN TO 80 FOR WORD PRO 4
34 REM SET LM FOR LEFT MARGIN OFFSET
35 :
40 INPUT"▒ENTER FILENAME    ▄███";FL$
100 OPEN 15,8,15
110 OPEN 2,8,2,DR$+FL$+",PRG,R"
120 INPUT#15,EN,EM$,ET,ES
130 IF EN<>0 THEN 1000
140 GET#2,C$,C$
190 :
200 OPEN 7,4,7: PRINT#7: CLOSE 7
210 OPEN 4,4
290 :
300 PRINT#4,SPC(LM);: FOR X=1 TO LN
320 GET#2,C$: IF ST<>0 THEN 1100
330 C=ASC(C$): IF C=31 THEN C=C+192: GOTO 380
350 ON (C/32)+1 GOTO 370,380,360,370
360 C=C+64
370 C=C+64
380 PRINT#4,CHR$(C);: NEXT: PRINT#4
390 :
400 GET C$: IF C$="" THEN 300
410 PRINT "▒▒▒PRESS ANY KEY TO CONTINUE, ▒Q■ TO QUIT"
420 GET C$: IF C$="" THEN 420
430 IF C$="Q" THEN 1200
440 GOTO 300
900 :
1000 PRINT:PRINT"▒DISK ERROR
1010 PRINT EN;EM$,ET;ES: GOTO 1200
1100 IF ST<>64 THEN PRINT "▒ERROR■   ST=";ST
1150 PRINT#4
1200 CLOSE 2:CLOSE 15: CLOSE 4
```

Listing 1. Word Pro source file printer.

I wrote the program for Word Pro 3, but it can be easily modified for Word Pro 4 and the 80-column machines. Simply change the value of LN in line 30 from 40 to 80. The value (LN) controls the line length. The value of LM (in the same line) controls an offset from the left margin before each line is printed. Its current value of 20 will center a 40-column line in an 80-column page. If you're changing the program for an 80-column machine, you should set this to zero, or eliminate the PRINT#4,SPC(LM) in line 300. The program is preset to only read files from drive zero as set in DR$.

Lines 40–130 get the file name of the desired Word Pro file and open the file as a sequential data file. Note that the older command channel disk commands are used. This lets you run to any disk with any appropriate BASIC.

Line 140 reads and ignores the two-byte program load address at the front of the file. Remember that the program load address is always passed as data whenever a program file is opened as a sequential data file.

Line 200 puts the CBM 2022/2023 printer in upper/lowercase mode as normally used for listings. Lines 300–380 then read the file character by character, using a GET# command. Each character is converted from its display (screen) value to its ASCII value for the printer. The back-arrow must be specially decoded.

At the end of each printed line, the keyboard is checked to see if you want to suspend output, quit or continue (lines 400–440). When the program is printing, hitting any key will suspend output and display a short message. Hitting Q at this point will close the disk file and end the program. Hitting any other key will con-

---

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tinue the output. The program will normally quit when the end of the disk file is detected. Any disk errors will be reported and the program will terminate after closing the files.

New VIC Happenings

The second and third program six-packs for the VIC-20 are a math improvement package for grades 1 through 6 and a collection of business and calculation programs.

By the way, Commodore is color-coding their tapes and cartridges for the VIC so you can easily identify the class of program:

Red = Games and recreational
Blue = Educational
Green = Business and calculation
Black = Computing aids
Orange = Home utilities

Speaking of cartridges, about ten cartridges are now available for the VIC. Some of the first ones available include: Invaders, Night Driver, Slot Machine, a poker game and Programmer's Aid. A Super Expander cartridge should also be available; it includes an additional 3K of random-access memory (RAM) along with graphics plotting and music writing commands. It will also let you easily change the programmable-function keys.

One other note of interest: the VIC game port accepts Atari joysticks! Commodore took this route because they feel the Atari controls are becoming an industry standard. Now, if they can just add a few simple joystick commands like the Atari 400/800 support, we'll really have something! For the time being, you must resort to the familiar PEEKs to read the joystick from BASIC.

VIC–PET Tapes

The VIC-20 was designed to be somewhat compatible with the existing PET/CBM machines, with certain limitations. You need to take a few precautions when loading PET/CBM programs into a VIC, or VIC programs into a PET/CBM.

A standard BASIC program tape created on a PET/CBM will load into a VIC without any problems, assuming that the program is reasonably small in size and will fit into the somewhat limited memory space of the VIC. The VIC will actually load the program at the start of available memory and correct the program link addresses.

A machine-language program tape created on a PET/CBM will normally not load into a VIC—you'll usually get a load error. Even if you don't, the machine-language program will probably not function properly, if it will run at all. All low memory pointers and the entire operating system ROM have been changed in the VIC.

A BASIC program tape created on a VIC can be loaded into a PET/CBM, but a few POKEs are usually required before you can LIST or RUN the program. If you have a VIC without any memory expansion, BASIC programs are stored starting at location 4097 ($1601 hex).

When you load a VIC program into a PET, it will be stored at the same address. However, a BASIC program in the PET normally starts at location 1025 ($0401). Thus, you must do a POKE 41,16 on the PET to set the starting address for BASIC to match the VIC-20. Also, you must do a POKE 4096,0 to put a zero byte before the first byte of the BASIC program for the PET's BASIC operating system to function properly. Once these two POKEs are performed you should be able to list or run the VIC program in the PET as normal.

If you add the Super Expander cartridge to the VIC, then the starting address for BASIC programs will be lower. Actually, they'll start at the same address as on the PET. Any programs created on an expanded VIC-20 will then be directly loadable on a PET/CBM system without doing any POKEs.

The two different starting addresses for VIC programs may present a few problems, but there is a simple way to check a program tape before actually attempting to load it. This procedure will work on any Commodore system, but the addresses must be changed for the VIC-20 since its tape buffer has been moved.

First, mount the desired program tape in the drive (TAPE#1 if a PET/CBM). Then enter an OPEN 1 command on the keyboard and press the recorder play button. The program name will be displayed once it is found. When the tape stops and READY reappears, enter the following command to find the starting address of the program on the tape:

```
PET/CBM:  PRINT PEEK(635) + (256•PEEK(636))
    VIC:  PRINT PEEK(829) + (256•PEEK(830))
```

If you want to find the last address of the program you can enter:

```
PET/CBM:  PRINT PEEK(637) + (256•PEEK(638))
    VIC:  PRINT PEEK(831) + (256•PEEK(832))
```

This can tell you whether or not the program will fit into your machine without even trying to actually load it. Also, you can check that the tape is really a program by doing a

```
PET/CBM:  PRINT PEEK(634)
    VIC:  PRINT PEEK(828)
```

If the value displayed is a one, then the tape does contain a program and not a data file.

These PEEKs are actually checking the data contained in a file header on the tape that is read into memory by the OPEN 1 command. Every PET, CBM or VIC tape file (whether program or data) contains a header that describes the type of file, the starting and ending addresses of program files and the file name. An OPEN command simply finds the appropriate tape file, reads the file header and then stops the tape. You can open any type of tape file but you can't read a program file from tape as data.

Programmable VIC Characters

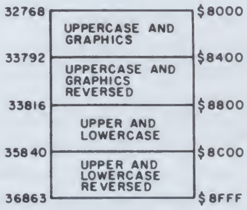
Remember that the VIC-20 has a programmable character set. The normal character ROM may be overridden by programmable character sets contained in RAM. To produce these programmable color characters, the VIC-20 uses three areas of memory: character pointers, display characters and color pointers.

The character pointer area contains a pointer for each particular character to be displayed. This table is referred to as the video matrix and is typically 506 bytes in length in RAM.

The character area consists of eight- or 16-byte blocks, called cells, which contain the actual dot patterns to be displayed. These character cells can be stored in ROM or RAM, depending on how they are to be used. This is the table that can be modified to create your own special character set.

The color pointer area is referred to as the color matrix. The four-bit color pointers define the color of any character to be displayed and selects one of the two color modes available.

The operating system organizes the video matrix, color matrix and character cells into the proper format to display the desired data on the screen. A typical video matrix defines 23 rows of 22 characters. This yields 506 character-display locations with a screen resolution of 176 horizontal by 184 vertical dots. Each of these character-display locations has a corresponding character pointer, or index, which points at a character pattern that is to be displayed at that particular location.



VIC character generator ROM.

At the time I was writing this column, Commodore was getting ready to release a programmable character editor program for the VIC-20. This program makes the creation of special character sets a real snap. You can save a character set on tape and later load it with a BASIC program for use in game graphics or whatever. A relocating loader that was still being developed is supposed to allow multiple sets of 64 characters to be loaded one after the other so that upper- and lowercase can be programmed.

The character editor program allows you to specify each point of an 8-by-8 mask for each character in the set. One nice feature allows you to build a picture made of more than one character. You can

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specify each character in a 3-by-3 grid when creating the special character. After seeing the preliminary version at work, the final version with good documentation should be nice when it's available.

VIC Memory Maps

I've included a few simple memory maps for the new VIC-20. If you look closely, you'll see that the low memory pointers have been changed and the cassette buffer was moved slightly from the PET/CBM design. Commodore is providing extensive information on the VIC, making it much easier to work with. There already is complete documentation (38 pages) available on over 36 user-callable operating system routines. The documentation includes the entry address, parameters expected and what registers are used, and preparatory routines required, error returns, stack requirements, a written description of the routine operation and sample calls. Hopefully this kind of support should help generate some interesting software from outside sources.

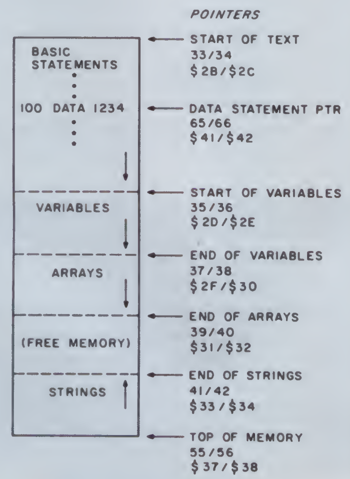
Miscellaneous

I just received sample issues of an interesting magazine from England called *Microcomputer Printout*. It proclaims to be "a plain man's guide to personal computing" and specializes in the PET. The two copies I received were excellent, with 68 pages full of interesting material. The advertisements were rather different, since there were a number of items from Europe that I haven't seen here in the states. The style of the magazine is much like that of *Compute*, but is almost entirely aimed at the PET.

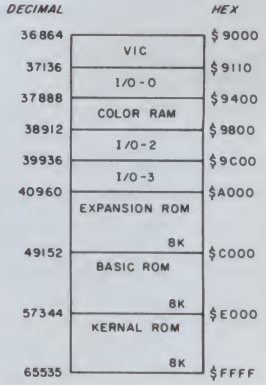
A usual 12-month airmail subscription for us here in the USA is a steep $58. However, the publisher is offering our readers a special half-price deal until Dec. 31 if you mention this column. At $29 for 12 issues, it's a bit more reasonable. Address orders and correspondence to: *Microcomputer Printout*, PO Box 48, Newbury, Berkshire RG16 0BD, England.

The latest *JINSAM Newsletter* tells about NASA's unique applications using 8032 CBM systems and JINSAM 8.0. They are using one system to keep track of recovery equipment and usage of equipment for the Columbia Shuttle. With five emergency landing sites around the world and one set of recovery equipment, it currently takes 17 C-130 transport planes to move everything. Just imagine that a CBM system like yours is keeping track of all those millions of dollars of equipment!

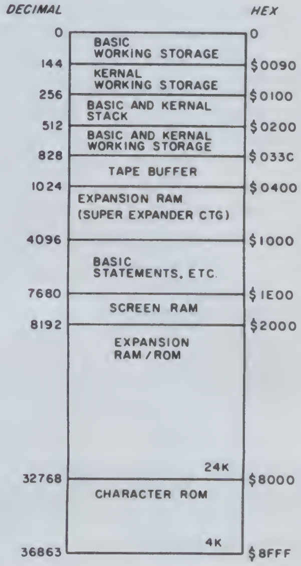
JINSAM 8.0 is also being used by engineers at the Central Instrumentation Facilities to store readings from transducers at Kennedy Space Center, on the Columbia, or at any of ten worldwide tracking locations. JINSAM is used to analyze the information as received and produces reports for maintenance, efficiency ratings, etc. Several other current and future applications were also mentioned in the summer newsletter, making rather interesting reading.☐



VIC BASIC storage.



VIC memory map (upper 28K).



VIC memory map (lower 36K).

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By Frank J. Derfler, Jr.

Life in the Fast Lane

Modems Designed For Speed

Do you want to set up your own electronic message system? This month, we'll look at an excellent software package that lets you turn your TRS-80 into an electronic message system. I'll also review a nice terminal program for CP/M users. But first, let's talk about going fast and getting rich.

Faster than 300 Baud

A recent discussion in this column on Bell 202 and 212 signalling has resulted in some mail on transmission speed and standards. Some of us have had the pleasant experience of moving up from a 110-baud mechanical printing terminal to a 300-baud device. The difference in performance seems much greater than the 270 percent speed-up shown by the numbers. Moving from 300 baud to 600 or even 1200 baud can make an even greater difference in your enjoyment of electronic message systems and information utilities. It can also reduce your telephone bill!

Most modems in use in the U.S. follow one of three standards established by the Bell system: Bell 103, 202 or 212. Bell 103 signalling is normally limited to a rate of 300 baud. Bell 202 and 212 standards are normally used for higher speeds, but they are very different from each other.

Other manufacturers have developed their own high-speed systems using signalling schemes different from the Bell system standards. The most common is the VA3400 protocol established by Racal-Vadic. This standard is also supported by Anderson Jacobson. Devices called "triple modems," which support Bell 103, Bell 212 and VA3400, are common in professional data communications operations.

Several companies have been able to push the 103 standard modems to speeds over 300 baud. The Potomac Micro-Magic S-100 bus integrated modem has proven its ability to operate reliably at 600 baud. Recent versions of Microperipheral Corporation's Microconnection modems are reported to be reliable at over 300 baud.

Telephone line quality affects the ability of any modem to operate at high speeds. Successful operation at over 300 baud with any 103-type modem should always be considered a bonus. No information utility will run at over 300 baud using the Bell 300 standard, but several message systems (including the AMRAD CBBS) will.

At the higher speeds (1200 baud), there seems to be a difference of opinion in the microcomputer communications community. Several readers have written that they think it is silly for Novation to offer 202-type signalling in their Apple-Cat II when 212 is the standard for interactive communications.

However, several amateur radio operators have been thrilled by Novation's offering because the 202 protocol gives them a 1200-baud system at a low price, and the one-way-at-a-time type of operation used under the 202 scheme is perfect for their kind of transmissions. However, the hams are not in the majority and they will probably want to talk to an information utility using the high-speed 212 protocol too. (Nobody ever wants to go back to 300 baud after he has used 1200.)

Getting Rich

There is a very large market waiting for a less expensive 1200-baud type 212 modem. Who will be the first to introduce one? Get busy and get rich! While I am on the subject of getting rich, the first person out with a simple plug-in parallel printer port for the Osborne I is sure to make a tidy sum. The opportunities to make a buck today are endless.

European Standards

I mentioned some European message systems a few months ago and I've had some inquiries about the signalling standards used in Europe. The International Committee on Telephone and Telegraph (CCITT) has stated its V.21 protocol this way:

300 baud Channel 1:	binary 1 (mark)	980 Hz
	binary 0 (space)	1180 Hz
Channel 2:	binary 1 (mark)	1650 Hz
	binary 0 (space)	1850 Hz

If you are determined to work the European systems, you will need a modem which operates on these frequencies. A European option is available on the Microconnection devices, and Novation has a European version of its popular CAT modem.

Call-Waiting

A recent circular from the local telephone company reminded me of a problem that many of you might be paying for in more ways than one. Do you get frustrated by mysterious interruptions in your data communications sessions? Many telephone customers have taken an option called Call-Waiting which gives a short beep on your phone line if the phone is in use when a call comes in. The second party gets a noisy crackle when the first party gets the beep. The crackle and the beep are quite enough to convince either modem that the other has quit, and a disconnect results.

Call-Waiting and data communications don't mix. If you have it and get mysteriously dumped in the middle of a session, you know why. Incidentally, the information utilities keep billing you for a number of minutes if you just disappear without signing off. So if competition for the telephone line is a problem, a separate telephone line might be a better option than Call-Waiting for the data communicator.

With the Information Utilities

I inspected CompuServe and The Source closely last month, but I have two quick comments: The new management at The Source has been on-board about six months now, so watch for changes. More

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DEALER INQUIRIES WELCOME.

features and a friendlier operating format should be coming up. Meanwhile, CompuServe is still moving at a steady pace. Its Microcomputer Advisory Service, presented by Battery Lane, is a nicely done interactive service which answers some tough questions for novice and pro microcomputer users. This dialogue is a very appropriate use of the medium.

A TRS-80 Message System

Many microcomputer users would like to operate their systems remotely. Integrated modems like the Hayes Microcomputer Systems Micromodem have this capability built in, but TRS-80 users have been left behind. Now, Lance Micklus has come up with a program which tucks itself away in the high memory of the TRS-80 and lets you operate the system remotely through the RS-232C port. This software also prepares an auto-answer modem to answer the phone and orders it to hang up when the user signs off.

Micklus calls the program ST80-X10, and it is available in both cassette and disk versions. The same program will work with the TRS-80 Model I or III. After loading, the program will build a host subroutine in high memory, memory protect and initialize itself and return to DOS or BASIC. The computer then interacts with both the keyboard and RS-232C port. The program is simple and effective.

ST80-X10 can be even more useful when it is run with the separate Communications Center (ST80-CC) software package. This BASIC program turns an ST80-X10-equipped TRS-80 into an electronic message system. The TRS-80 must have at least 48K and two disk drives to carry an effective number of messages. This configuration will allow about 25 to 50 messages to be kept online—depending on how many lines you allow each message to have.

The Communications Center package operates in two modes. In the more common mode, the entire system—program and all messages—is held in RAM. The program is self-maintaining in that it will write over the least significant information first when RAM space devoted to messages is full.

The program can differentiate between four levels of users: guest, member, owner and operator. Each kind of user has a different level of privileges. The name of the user and the level of privilege assigned determine what messages a user can see.

A unique "personal only" option makes all messages not addressed to the individual invisible. This, in effect, provides a personal mailbox service. Options which allow all users to see all messages or only certain messages are available by simple commands.

In its second mode of operation, the program can allow the user access to programs stored on the disks. Programs can be run in the host system or uploaded and downloaded between the host and remote user. A password system prevents unauthorized users from writing disk files, and only certain drives are available to normal users. This prevents the system from being crashed by vandals.

ST80-CC comes in a hardcover binder with extensive operating and installation instructions. The program has many options, but they are explained in the documentation along with examples. ST80-X10 has less documentation, but the options it provides are explained clearly.

The message system created by combining ST80-CC and ST80-X10 has particularly good potential as a communications center for clubs, private organizations, schools and businesses. Development and study teams, travelling salespeople, dealers, suppliers and others could put this message system to good use. ST80-X10 costs about $50 and can be used alone for remote operation. ST80-CC also costs about $50, but you need both programs for the complete message system. A cassette version of the message program called ST80-PBB is available for $30. It will run on a 16K TRS-80. The entire ST80 line is available from the Small Business Systems Group.

Crosstalk

Many different kinds of communications programs are available which run under the CP/M operating system from Digital Research. But most have a specific function (driving a modem or transmitting a file) or run only on certain machines (Z-Term for the Apple II with CP/M, for example). None of them brought together all of the smart-terminal features in one package able to run on most CP/M-equipped computers. Crosstalk, from the Microstuf Company, now gives CP/M data communicators smart-terminal features in one user-friendly package.

Crosstalk was originally developed for the North Star Horizon computer, using the Hayes or PMMI integrated S-100 bus modems. The program can now be adapted to run on any CP/M machine with an integral modem or a serial port, but you do have to specify either the integral or serial version when ordering.

The version for use with integral modems is easy to install because these modems always use the same I/O port locations. Serial versions for the Horizon and TRS-80 Model II computers are ready to run. The program can be configured for other computers with serial ports if you know the appropriate I/O locations. Les Freed from Microstuf offers to help his customers by phone or mail with any installation problems.

The Crosstalk program turns a CP/M-equipped computer into a terminal capable of automatically dialing prestored telephone numbers, transmitting CP/M files, saving received data in CP/M files and transferring data files using the same protocol as CLINK and other popular file transfer programs. This feature provides very accurate file transfer, but it must be used with another machine running Crosstalk or a program with the same protocol.

Operation of the program is controlled from a menu which offers four levels of help to the user. Frequent users of the program can quickly get in and out of the menu. New or infrequent users can get all of the help they need to use Crosstalk while they are on-line, ending frantic reference to the manuals.

One feature of Crosstalk should have been done a little differently. When the program is simply transmitting a file (not transferring it with the error-checking feature), it transmits line-by-line, waiting for a carriage return before transmitting the next line.

A speed option can also put a variable-length delay between characters so that distant end systems and carrier systems are not overrun. This combination makes it possible to send prepared electronic mail files to an ABBS, CBBS or to The Source. But some systems, particularly CompuServe's EMAIL, want the transmitting program to respond only to a specific prompt other than a carriage return.

It would be difficult to send a message of over ten lines through EMAIL using Crosstalk. This limitation could be overcome if the prompt recognized by Crosstalk could be easily changed from the menu.

Crosstalk falls into the category of good, hard-working software. It is practical, but not frilly. That description fits CP/M too, so CP/M users should love it. Crosstalk is available for about $150 from the Microstuf Company.

Tell me!

If you have a data communications product that you think could make you rich, let me help. Drop me a line on The Source at TCB967, on CompuServe at 70003,455 or on the AMRAD CBBS at 703-734-1387.□

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COMPUTER BLACKBOARD

By Walter Koetke

Let Your Micro "Strut Its Stuff"

Problems Best Solved By Computer

Do you teach students whose programming abilities far exceed those of everyone else? Are you tired of watching your children write programs to solve problems that are more readily solved with pencil, paper and perhaps a calculator? Here are five problems that might be of interest to you. All are appropriate for secondary school students, and several can be used with mid- and upper-level elementary students. Solutions are likely to require a computer and considerable thought. All could inspire additional questions before a solution is obtained.

1. Let's begin with a briefly stated historical question. Although this problem cannot be described as realistic, the battle account on which it is based is historically accurate. The following unusual fact is known about one of the first recorded battles after the establishment of European colonists in what is now the U.S.

"The product of the year of the battle, the day of the month of the battle, the number of the month of the battle and the average length (to the nearest inch) of the bows found at the battle site is 3486810." Given the additional fact that the battle was fought in the late spring, give the exact date of the battle.

After you calculate the date of the battle, you might be interested in determining who fought the battle, where they fought and why they fought. Although these questions won't involve the computer, finding answers may be tougher and more interesting than determining the date.

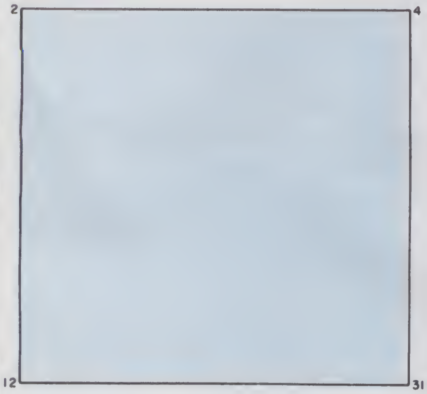


Fig. 1.

2. Draw a square, then choose four positive integers, each less than 100, and write them in any order at the vertices. For example, suppose you choose 2, 4, 12 and 31. You might then draw and label a square as in Fig. 1. Now draw another square inside the first as in Fig. 2. At the vertices of this square, write the absolute value of the difference of the numbers at the two corresponding vertices of the larger square. Repeat this process until you obtain a square whose vertices are all labeled with the same numbers as shown in Fig. 3. Now that this process is well understood, you're ready to address a few questions:

A. Write a program that will permit a user to enter the first four integers to be used when labeling the vertices. The output of the program should then be the numbers to be used as labels on all subsequent squares until the sequence ends with four identical labels.

B. If the first four integers are positive integers less than or equal to 15, which four numbers will generate the largest number of squares before the final square is obtained? In what order must these numbers be placed?

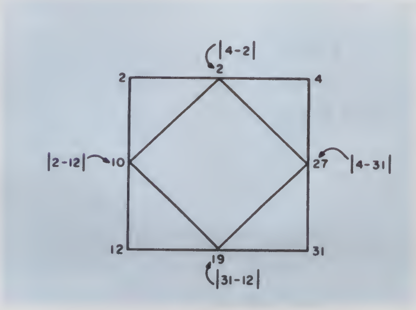


Fig. 2.

3. As you already know, the set of rational numbers between 0 and 1 is infinite. However, the following table will contain any specific one of these numbers if the table is extended sufficiently.

1/1
1/2
1/3 2/3
1/4 3/4
1/5 2/5 3/5 4/5
1/6 5/6
1/7 2/7 3/7 4/7 5/7 6/7
1/8 3/8 5/8 7/8
1/9 2/9 4/9 5/9 7/9 8/9
1/10 3/10 7/10 9/10
1/11 2/11 3/11 4/11 5/11 6/11 7/11 8/11 9/11 10/11
1/12 5/12 7/12 11/12
.
.
.

Many interesting questions can be asked about this table of fractions. Several of these questions involve a correspondence between the counting numbers and the fractions in the table. This correspondence is based simply on the order of occurrence within the fraction table. For example, the 1st term is 1/1, the 5th term is 1/4, the 28th term is 8/9, and so forth.

Notice the term number of each term in

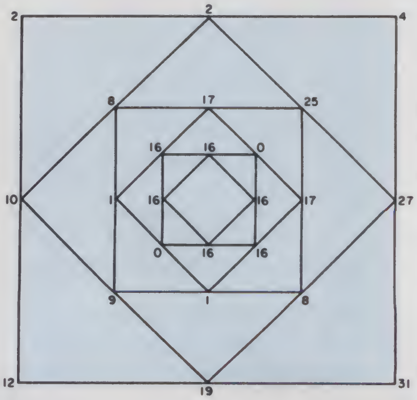
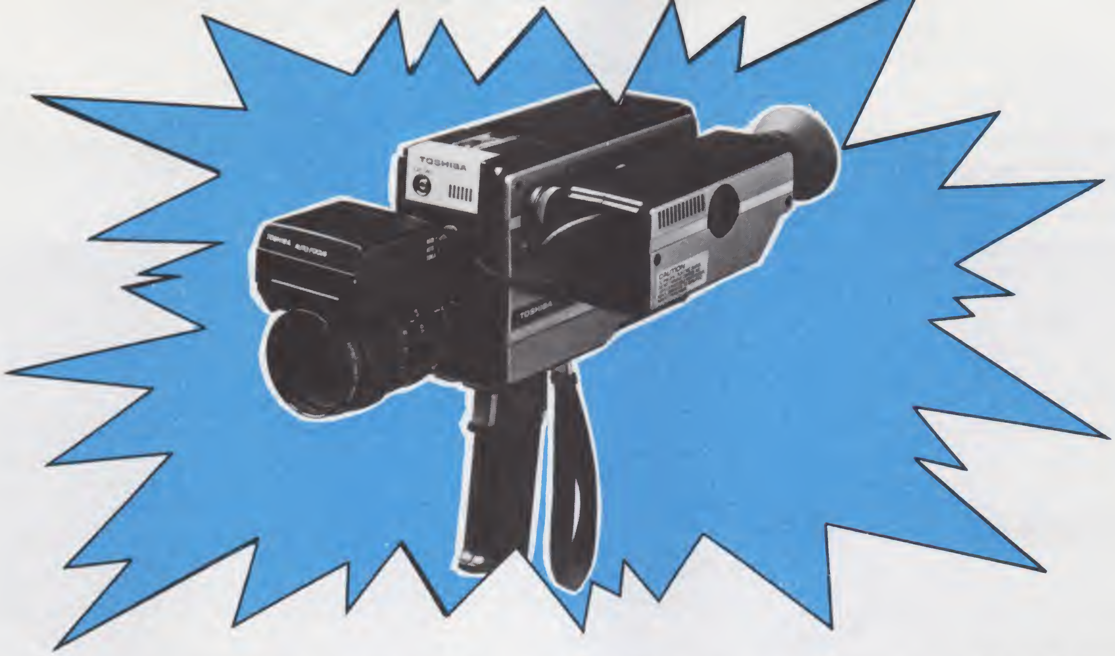


Fig. 3.

Walter Koetke, Putnam/Northern Westchester BOCES, Yorktown Heights, NY 10598.



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VIDEOPLAY magazine wants to publish plans for interesting and practical home video centers which tie together videocassette recorder/players, TV receivers, video games, stereos and what have you. If you've designed and put together such a set-up, submit your plans, pictures and a brief write-up of how it works, and you may win the top prize - a brand new, $1,400 Toshiba color video camera with auto focus.

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Each entry must include plans, a list of materials and photos and an entry form such as the one below. All entries must be postmarked no later than November 25, 1981. If the contestant is under 18 years of age, the entry must also be signed by a parent or guardian.

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the first column. 1/1 is the 1st term, 1/2 is 2nd, 1/3 is 3rd, 1/4 is 5th, 1/5 is 7th, 1/6 is 11th, 1/7 is 13th, ... Does this pattern indicate that the number of the first term in each row (except the first) will always be prime?

Except for the first two rows of the table, which each contain only one fraction, all other rows contain an even number of fractions. Will this pattern continue? Will all subsequent rows contain an even number of entries?

Five of the first six rows contain only one or two fractions. Will any other rows contain as few as one or two entries?

What is the denominator used in the line containing the largest number of entries in the extended table? Is there a single line for which the set of entries is infinite?

Your task is to write a program to answer these and similar questions. Your program should permit the user to enter the number of a term. The program should then calculate and print the fraction corresponding to that term. For example, if the user enters 8, the fraction 2/5 should be printed. If the user enters 1032, the fraction . . . let your program calculate this one.

An alternative program would permit the user to enter the numerator and denominator of a fraction, and would then calculate and print the number associated with that fraction. If you feel that this or your own alternative program will better answer the suggested questions, write the program you prefer. Efficiency will be important no matter which form you choose to write; your program must complete all computations within a reasonable time.

4. The trapping game is a quickly-learned board game played by two players. The board consists of seven circles connected by line segments representing paths between the circles, as in Fig. 4. The circles are numbered 1 through 7 for easy reference. The first player has one marker which is placed in circle 1. This player can win the game in either of two ways. He wins if he can make any ten moves or if he can move his marker to circle 7. The second player has three markers that are placed in circles 5, 6 and 7. The second player can win only by trapping his opponent's marker. Players alternate moves, the player with the single marker always moving first. A player can move his marker from the circle it occupies to any adjacent vacant circle. This movement must be made along one of the segments connecting the circles. A sample game is illustrated in Fig. 5.

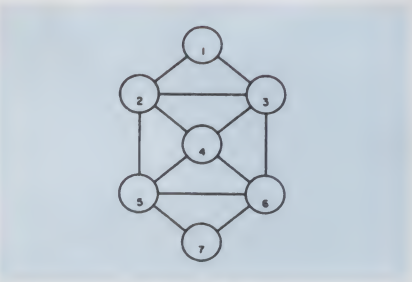


Fig. 4.

Play the trapping game with a friend. You can draw the board and use almost any objects as markers. Be sure you try both the first and the second player's role. Don't proceed with this problem until you have played several games and developed a strategy for winning.

Write a program that will play the trapping game with a user. The program should make the computer the second player and the user the first player. The following output was printed from a sample program. Notice that the game played is identical to the one illustrated in the preceding diagrams. The circled numbers represent the moves entered by the user.

```
RUN

YOU SHOULD READ THE GAME RULES BEFORE
STARTING

YOU MOVE FROM 1 TO ?  3
I MOVE FROM      5 TO    4

YOU MOVE FROM 3 TO ?  1
I MOVE FROM      7 TO    5

YOU MOVE FROM 1 TO ?  3
I MOVE FROM      5 TO    2.  AND YOU'RE IN
                             TROUBLE!

YOU MUST MOVE FROM 3 TO 1
AND I WIN BY MOVING FROM 6 TO 3
```

When you write your program, try to incorporate any knowledge you gained while playing the game. If you can write an unbeatable program, do it. If you write a program that can only be beaten in one way, that's almost as good.

After you've written a program that plays the game well, you might try adding graphics, which would make the program much more interesting for the user.

5. Our final problem comes from elementary school arithmetic. Expressing fractions in lowest terms is a habit you should have developed a long time ago. You can, for example, write 16/64 as 1/4 and 49/98 as 1/2. Since you're already familiar with the correct procedure for expressing fractions in lowest terms, let's now consider an incorrect procedure.

The fraction 16/64 might be reduced to 1/4 by just deleting the 6s from numerator and denominator. 16/64 = 1/4. Similarly, 49/98 = 4/8 = 1/2 might be reduced by deleting the 9's from numerator and denominator. Have we discovered a new

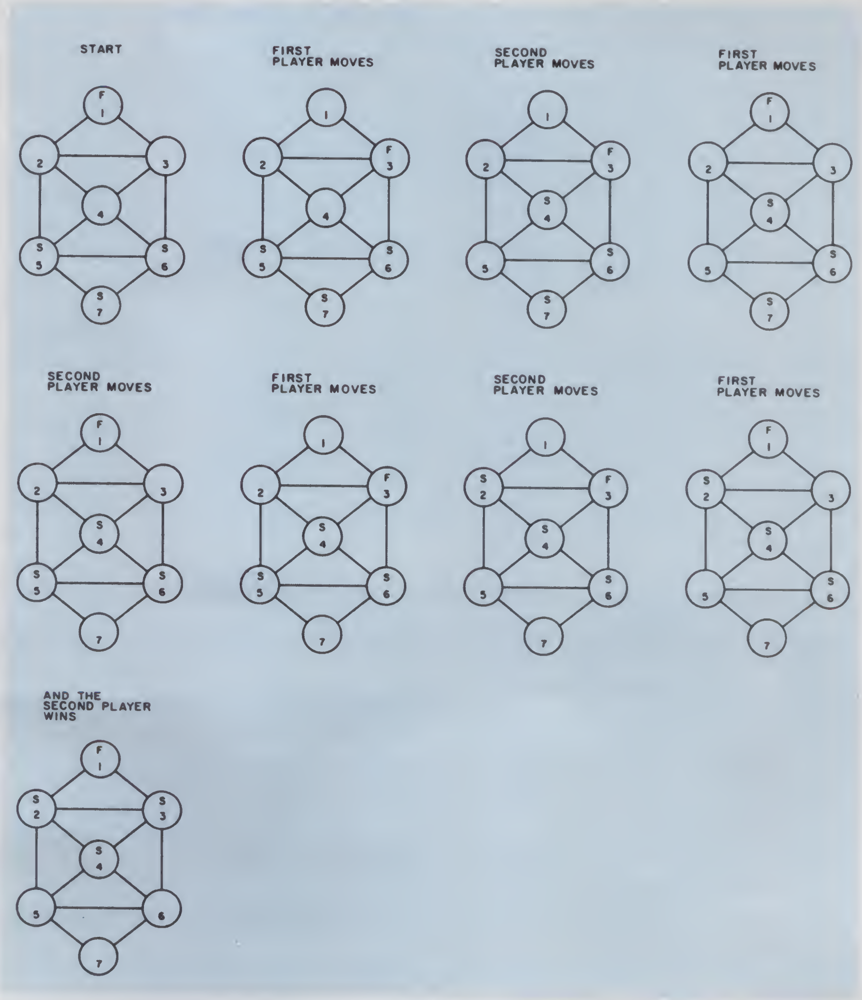


Fig. 5.

technique? Given a fraction of the form AB/BC, where A, B and C can be any of the digits 1 through 9, does A/C always represent a reduced form of that fraction? Unfortunately the answer to both questions is no. Our new procedure, let's call it "careless cancellation," is not generally valid. Nevertheless, you will find the following problems of interest.

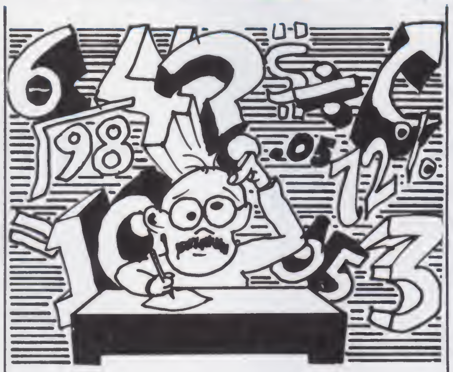
A. For which values of A, B and C does AB/BC = A/C? The domain of A, B and C is the set of integers 1 through 9 with the additional restriction that no two values are equal.

B. For which values of A, B, C, D and E does ABC/BDE = AC/DE? The domain of the five variables is the set of integers 1 through 9 with the additional restriction that no two values are equal.

If you've created or stumbled upon any problems especially appropriate for students with access to computers, please let me know. Next month's column will be similar, and an occasional future column might focus on reader-contributed problems if that appears to be of interest.

As you tackle these problems or suggest them to a student, remember that the computer is only one of the tools to be used in obtaining a solution. As with many tools, it can support but not replace thinking. If you create a particularly clever solution, I'd like to see it.☐

MICRO QUIZ



Analysis of Algorithms

What sequence of numbers is output when the following program is executed?

```
DATA 5, 3, 4, 2, 1
FOR I = 1 TO 5
  READ A(I)
NEXT I
DATA 3, 5, 2, 4, 1
FOR J = 1 TO 5
  READ R(J)
NEXT J
FOR K = 1 TO 5
  PRINT R(A(K))
NEXT K
```

Answer on page 222.

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Audio Reinforces Learning

Audiotex—a Sound Idea

The Online Computer Library Center has come up with a novel use for the telephone.

Audio transmission.

That's right. If the Columbus-based computer service and research organization has its way, you'll soon be able to pick up your phone and get sound.

In fact, with a few modifications, you might be able to carry on two-way conversations. With another person, even.

The OCLC's idea isn't as absurd as it may first seem. The audio transmission they're talking about would be combined with existing data transmission technology to provide what the library calls an audio-enhanced videotext system. It would let users of viewdata services—which transmit data over telephone lines through a modem and onto your television screen—retrieve both text and sound from the host database.

For example, an encyclopedia entry on the double-breasted sapsucker would be accompanied by that bird's sound. Or a biography of John F. Kennedy could include a recording of his inaugural speech.

The OCLC has given such a service the name of audiotex, and calls its particular brand of audiotex ViewTel. The hardware used with ViewTel is pretty much standard, with the exception of a slightly modified decoder at the receiving end and an Instavox RA-12 rapid access audio unit at the host system.

The Instavox unit, from Education and Information Systems, Inc., in Champaign, IL, operates much like a floppy-disk system used for data storage, only the disk is 15 inches in diameter. It stores 27 to 44 minutes of audio, depending on the kind of audio required.

The Instavox RA-12 rapid access audio unit, from Education and Information Systems, Inc., is being used by the OCLC as part of their audiotex system.

The OCLC method is the least-expensive and simplest of several ways to transmit audio and data over the same line. As a result, ViewTel sacrifices simultaneity—the user cannot receive sound and text at the same time. He must therefore switch into an audio mode, and receive the recording while the text is frozen on the screen.

Mark Bendig, an OCLC research associate, says that the ViewTel project emerged from a recent OCLC videotext experiment called Channel 2000 (see Micro-Scope, October 1981, p. 28), which was a conventional text-only viewdata service.

"What impressed us was the fact that none of the existing videotext services have made use of the audio capabilities," he says.

Audio transmission, he says, has several other possible uses besides enhanced textual material. For instance, a speech synthesizer could be placed in the decoder, the device which translates the videotext signal from the telephone to the television. This synthesizer could have a fixed vocabulary, or could generate phonemes to create words. Voice messages, special codes and the like could be controlled either locally or by the remote computer.

But, says Bendig, the largest application—"and perhaps the most exalted of all"—is two-way audiotex. Here, the user could actually talk with a microphone to a mediator at the host system. The user would describe what information he was looking for, and the mediator would connect the customer to the computer's appropriate database.

At first glance, this may seem like a step backward. Videotext services presumably eliminate human intermediaries, and put the consumer in direct contact with the computer. But Bendig points out that database users traditionally have fairly sophisticated skills, skills which the average consumer generally doesn't have.

"We take a sophisticated service and hand it to a naive user at home," he says. "We impose a rigid kind of access constraint—the menu tree. This is okay for a limited number of sources, but you run into a problem with a vast database. Can you imagine using a menu tree to sift through the contents of an entire database?

"So what we propose to do is in effect take the existing kind of videotext system and replace part of it with humans. It has a human being explicitly as part of the system to make meaningful to the average user the idea of using a computer."

Bendig says that the decoder will be able to answer the telephone and record a message. Thus, a librarian, for example, could take a request for information and respond while the user is not around.

Bendig acknowledges that ViewTel has several potential problems. First, the audio portion of an audio-enhanced database would have to be developed from scratch. "You would have to make your own; there aren't any yet," he says.

Second, the quality of the sound could be less than optimal. The signal has to go through the telephone lines, the decoder, the modulator, the TV circuitry and the amplifier before it even reaches the speaker. And, as Bendig points out, television speakers are not designed for high-fidelity sound.

"But voice transmission will come out okay," he says. "I suspect it will be better than you get in a normal phone conversation."

The OCLC has prepared a prototype of the system, using a North Star microcomputer as the host. Bendig says that the Center has no plans to start up a ViewTel service of its own, but hopes instead to provide it to other videotext services. And he thinks that the interest will be there.

"One sound is worth 32 by 16 characters," he concludes.

—Eric Maloney

An Apple a Day . . .

It is an accepted fact that doctors no longer make house calls, probably because they don't need to. But they sure do make telephone calls.

Take, for example, the doctors in residence at the Ventura, CA, General Hospital. They sometimes make as many as 200 calls a day from the hospital to the neighboring clinic. Even Alexander G. Bell would have cringed at the sight of the jammed switchboard and harried medical secretaries trying to untangle the confusion. Enter the Apple II computer.

The 32 doctors in residence at General Hospital have a variety of patients in the hospital, and others who make regular visits to the out-patient clinic. Each doctor is required to make his rounds and be on call during certain hours of the day in the hospital. In addition, each doctor may see several patients in the clinic during the course of a day. It is something of a problem for a busy physician to remember the schedules for his clinic and hospital activities.

Hence, the clinic, in the pre-Apple era, was often deluged with telephone calls from doctors wondering about their out-patient schedule. It also was difficult for the clinic staff to update the residents on patient cancellations, no-shows and late arrivals.

General Hospital is a modern, well-equipped facility using an in-house closed-circuit television system to display information for staff and visitors. This system was ideal for the display of the out-patient schedules that could keep doctors posted on happenings in the clinic. The hospital technical staff decided that a microcomputer would be the ideal storage device for this information. The hookup to the existing closed-circuit system would be a simple interface.

The hospital selected an Apple computer because of its low cost and flexibility. The software for the system was designed to permit a display of the out-patient schedule at least an hour in advance. The display was designed to allow the doctor to tell at a glance when a patient was scheduled, *and* when the patient arrived. This eliminated dozens of phone calls between the hospital and clinic.

The system provided additional benefits as well. Because they were no longer fielding so many telephone calls, the nurses in the family care center were freed up to perform their regular duties. This resulted in greater efficiency in clinic operations. The residents used their time more efficiently as well, budgeting their hospital hours more carefully, secure in the knowledge that there was no doubt as to their next clinic appointment. The overall increase in staff efficiency was eventually reflected in an increased patient flow.

The telephone calls between the hospital and the clinic were the most tangible measure of the viability of the system. These calls were monitored for four weeks prior to the installation of the system and for four weeks after its installation. The reduction in calls was dramatic—from 536 to 324, a 40 percent drop. In subsequent weeks, as the staff became more comfortable with the system, the calls decreased still further. A survey of the staff showed overwhelming approval of the system.

The information necessary to run the clinic is still the same as it was before. Communication is still vital to the smooth operation of the clinic. The difference the microcomputer made was simple, but elemental—it got things organized.

G. Michael Vose
***Microcomputing* staff**

Apples on the Reservation

Dr. Clayton Curtis is a former electrical engineer who used to be a mainframe systems programmer. He gave up programming for medicine because he wanted to help people. So what is he doing now for the U.S. Bureau of Indian Affairs Health Service?

"I'm working out of the Office of Research and Development for Health Information Services as a programmer," says Curtis from his office in Tucson, AZ. "One of the projects I'm working on is the development of a database of patient information at our central offices which can be accessed by individual doctors at their clinics using Apple microcomputers, modems and regular telephone lines."

The Indian Health Service in the Southwest comprises several clinics, each with two to four doctors, a nursing staff, pharmacy and rudimentary lab facilities. Each of these clinics serves a particular clientele, but all need to access the records kept on patients by the Service's headquarters. In addition, doctors are frequently required to obtain clinical as well as patient information from the central offices.

Curtis, through a long association with computer technology, is anxious to help his colleagues exploit the potential of the microcomputer. "Microcomputers are useful because they can allow the doctor to control the input of information into the overall database. Doctors are notoriously impatient with their client information systems, whether they happen to be file cabinets full of patient folders or computers. With a microcomputer, the doctor can feel like he is more in control of the information input and retrieval process."

Curtis and his team are trying to develop a system to track a patient's problem list, medications, the clinical details of the problem management strategy, standard diagnostic checks, visit planning and other details. Some Indian tribes are plagued by specific classes of health problems, apparently due to heredity.

For example, Curtis says, "The Papago Tribe has a history of a high incidence of diabetes and gall bladder trouble but little heart disease. The Navajos have a lot of heart disease, related to streptococcus infection, but little diabetes. Treatment strategies for a particular patient or a familial group can be tracked by computer so that the physician can quickly determine what treatments have worked before and which have not."

Curtis asserts that micros today are at the level that minicomputers were at 15 years ago. "The small size and low cost of a microcomputer makes the building of a system such as the one we are working on feasible. Microcomputers that can support high-resolution graphics, voice input, touch-sensitive CRT screens and other innovations will broaden the scope of the applications for these machines in the medical field."

Curtis and his staff are using the MUMPS language in their development system. MUMPS only recently became available for the Apple computers used by the Indian Health Service, but Curtis feels that, for clinical applications, it is an excellent language.

"Some of the things that are complicated to do in BASIC or Pascal are easy to do in MUMPS," he says.

Questions on the systems being developed by Curtis and the Indian Health Service can be addressed to Curtis in care of PO Box 11340, Tucson, AZ 85734.

G. Michael Vose
***Microcomputing* staff**

Net for Special Education

Special education administrators now have their own communications and information network.

The net, called SpecialNet, is sponsored by the National Association of State Directors of Special Education. It offers an electronic mail service and several bulletin boards, for administrators who need to quickly access up-to-date information on special education topics.

A key bulletin board, Litigation, offers information on laws regarding handicapped persons, and provides access to the Education for the Handicapped Law Review (EHLR) in Washington, DC.

Personnel Preparation and Training is a bulletin board devoted to new techniques in training special educators. It also reports important developments in ways to work with the handicapped.

The Federal bulletin board lists new federal laws that affect the handicapped, bills currently in Congress, and information regarding funding.

Other bulletin boards include computer applications, employment opportunities, a consultant resource bank, a conference schedule, new products, new publications, assistive devices, advocacy group information and editorials.

In keeping with SpecialNet's orientation toward rapid access to information, bulletin board entries are kept concise (under 40 lines).

Although the system has just started, it is "moving very rapidly," says spokesman Gary Snodgrass. "We'd like for it to be as broad as possible," he says, reaching across various disciplines such as medicine, rehabilitation and education.

SpecialNet can be used by any ASCII-standard, asynchronous microcomputer. Subscriptions cost $200 a year. Costs for access time vary according to the time of day the system is used: $14 per hour from 7 AM to 6 PM, $7 from 6 to 9 PM on weekends and holidays and $4 from 9 PM to 7 AM.

Lise Markus
***Microcomputing* staff**

The Source's $ource

"If you thought The Source was all fun and games, wait till you see how it works for your business," reads a recent ad from Source Telecomputing Corp.

It's understandable that the McLean, VA, electronic information service is making a pitch to the business community. A recent survey of its subscribers shows that over 40 percent subscribe to The Source for business or work, while 50 percent say they will use The Source for business-related reasons during the next 12 months.

The survey, which included 48 percent of The Source's 10,000 subscribers, shows that the information service is attracting a decidedly well-educated and affluent clientele. The typical user is a 37.6-year-old male with a college degree or better, and makes $39,000 a year.

The study shows that while 44 percent of The Source's subscribers a year ago belonged to computer clubs, only 27 percent do so today. Three times as many businessmen and managers are likely to use the service than engineers, scientists, professionals or people in computer-related jobs. Forty-two percent are businessmen or managers, 16 percent are engineers or scientists, 14 percent are in the computer field and 12 percent are professionals.

The most popular services among business professionals include research, electronic mail, business planning and forecasting, news and financial market monitoring, personal portfolio maintenance and home education.

"When computers were made easily accessible to the individual in the mid-1970s, persons employed in the computer field were the first to use them, and they treated them as a hobby," said STC Vice-President A. Martin Clark in a prepared statement. "Now we are seeing a rapid spread of practical interest in the benefits of electronic, computer-based services among business professionals."

Medical Data on Line

An electronic information system for doctors is being developed by the American Medical Association and General Telephone and Electronics.

The system, due to go on-line sometime in mid-1982, will feature an encyclopedic database for use in patient diagnosis and treatment. Doctors will access the database through GTE's Telenet communications system, with either a terminal or a microcomputer.

The exact nature of the information to be provided is not yet known, says AMA spokesman Tom Toftley. They're starting out with drug evaluation information, he says, primarily because the AMA recently published its fourth edition of the hard-copy version, and has the data readily available.

A spokesman from GTE says that the service will be initially marketed to hospitals and clinics. It will then be expanded to include private physicians.

Toftley says that the potential market includes 425,000 doctors, 7000 hospitals and 15,000 group practices.

The two organizations have not yet set a price for the service.

Newspapers to Stay

While the electronic newspaper will play an increasing part in American life, more than 90 percent of newspaper subscribers will continue to buy the paper version of their newspaper, says a recent report from International Resource Development.

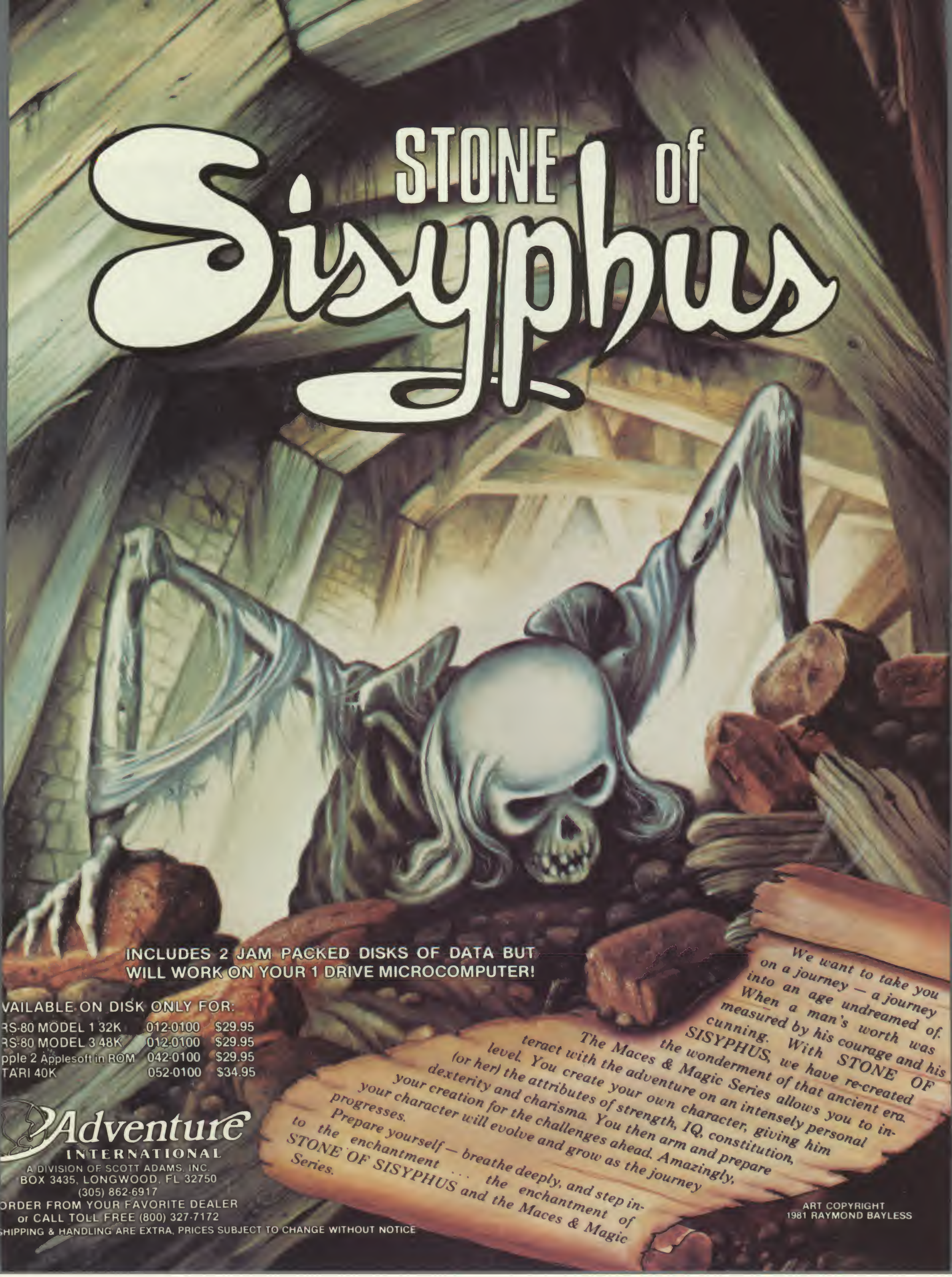
The report says that during the 80s, the market for electronic newspaper services will grow to more than $500 *million*, divided evenly between consumer and business uses. But such services will be used by a relatively small portion of the population.

Electronic newspaper services are most likely to provide an enhancement to conventional newspapers, the study says. These services will most benefit those with microcomputers, videotext terminals or specially-adapted FM radios, and include:

- Demand updates, in which a terminal or microcomputer user can get detailed information on stories he or she finds in the paper;
- Broadcast updates, in which the terminal user receives information on topics he has indicated a special interest in; and
- Broadcast updates by FM sideband, in which the user receives news on previously-selected topics through his radio either verbally or on a terminal or printer.

The report says that such products will be most profitable to newspapers with established electronic newsrooms, in which the electronic newspaper is a byproduct of an existing system. Newspaper companies will thus most likely dominate the electronic news business, although Ted Turner's Cable Network News or the Westinghouse news network could offer competition.

The report also says that electronic news will foster the development of "boutique" suppliers of news on specialized topics. These suppliers may focus on offbeat news stories, sports and particular hobbies.☐



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By Eric Maloney

Micro Monikers

A Micro By Any Other Name . . .

"What is a 'personal computer'?" William Safire asks in a recent *New York Times* column. "Presumably it means that one person can work it, but can't one person work any computer?"

Safire is a little bit off the mark. In the micro world, a "personal" computer is one that can be used *exclusively* by one person (as opposed to a timesharing system, which can be used by one person but is also used by many others), and one whose applications are usually personal (personal finance, home security and the like). It also implies a certain size, cost and ease of use.

But the point is well-taken—the term "personal computer" has its problems.

First, it smacks of Madison Avenue hucksterism. Everything today is personal, from cars to hygiene sprays. If a product isn't personal, it's at least personalized—for example, bath towels, keychains, horoscopes and coffee mugs. A personal computer sounds like something you'd get for $2.95 and a dozen Wheaties box tops.

Second, the term connotes fun, games and frivolity. It conjures up images of Mom, Dad, Buddy, Sis and Spot in the living room playing Space Scum, or Mom in the kitchen cheerfully retrieving a recipe for steamed hot dogs, or (at best) Dad trying to figure out how to avoid having his car reclaimed. A personal computer is not much more than an expensive toy, and certainly not something that a serious businessman would be attracted to.

The term home computer suffers from many of the same problems. Again, it's a device that belongs in the home next to the stereo and the pong game, not in the office, school or laboratory.

So what do we call these things? What name gives an accurate picture of what they can do, both in the home and in business or school?

Microcomputer is the broadest of the generic terms being used. It lumps together a wide variety of machines, which vary in power but are similar in price and size. But microcomputer is an ill-advised marketing term—it has a technical aura that places it in the serious computer or science lab. As Jim Edlin points out in *InfoWorld*, "It still says, plain as day, 'this product is some kind of a computer.' And right now, like it or lump it, the general public is indifferent or hostile to the idea of having computers."

That leaves us with the term desktop. While it accurately describes the average micro/home/personal computer, it perhaps suffers from being identified too strongly with business. Also, as micros become more portable, and as they begin appearing in environments in which desks don't even exist (cars and bus terminals, for example), the term will lose some of its accuracy.

Perhaps the market is too diverse to settle for one term. As microcomputer manufacturers shape their marketing strategies, they're each beginning to focus on a more specific group of consumers. It's possible that, while all are selling microcomputers, some will sell home computers while others will sell desktop computers, just as automobile manufacturers sell luxury, family and compact cars.

One thing's for certain—we've come a long way since the days of the first mainframes. How'd you like to go into your local Radio Shack and ask to see their latest Electronic Numerical Integrator and Computer?

* * * * *

The IBM Personal Computer raised some questions here about the use of the letter K to indicate kilobytes of memory, as in 16K RAM. The problem is that K means one thousand, and thus can mean either one thousand bytes or 1000 words.

This is fine when describing a machine with an eight-bit microprocessor. One word—the number of bits capable of being stored in one location—is eight bits, which happens to be what a byte is. Thus, a byte and a word are the same.

But in a 16-bit microprocessor, such as IBM's, a word is equal to 16 bits. Thus, there are *two* bytes to each word. In such a case, 8K RAM could mean 8K bytes (4K words) or 8K words (16K bytes).

So we've started to use K byte instead of K alone. We hope that this will anticipate potential reader confusion. Microcomputers can be confusing enough as it is.

* * * * *

Another objection to my objection to the word keyboard as a verb, this one from *Northwest Computer News* editor Bob Woodbury (whose excellent article "Beyond Gutenberg" appeared in our May 1981 word processing issue):

"In word processing, creating a file involves a lot of typing (continuous entry of words), but also a lot of inserting, deleting, retrieving, entering and other things not possible on a typewriter. 'Type,' as a verb, does not describe this activity. This verb should only be used to describe a particular phase of word processing. After all, why do we have word processors rather than electronic typewriters?

"Word processors promote a new way of thinking about the process of getting thoughts into print. New words will be required, or the meanings of old words will change. Maybe 'keyboard' will become an accepted verb. It is already a part of the technical jargon, and jargon often ends up in common use. Maybe 'type' will take on a new meaning which includes all the activities of word processing.

"Language purists get stomach trouble when they see or hear nouns used as verbs or vice versa unless this use has been sanctioned by time. I think an evolving language will see a lot of this, and that it is good if the new use does not obscure meaning. The use of 'keyboard' as a verb is clear in meaning."

Well-said. I'll concede that the word keyboard has entered the language as a functional verb (function is, I think, more important than time to the sanctioning of a word). And I'll agree that there is a lot of activity on a computer keyboard not accurately described by the verb type (although a typewriter has similar activity, such as back spacing, setting and clearing tabs, shift-locking and carriage returning, which are covered by the verb type).

But much of the time writers use the word keyboard to describe the entering of straight text. So why not use type? It's shorter, cleaner, and more familiar to noncomputerists. ☐

Reader Service for facing page ✓407→

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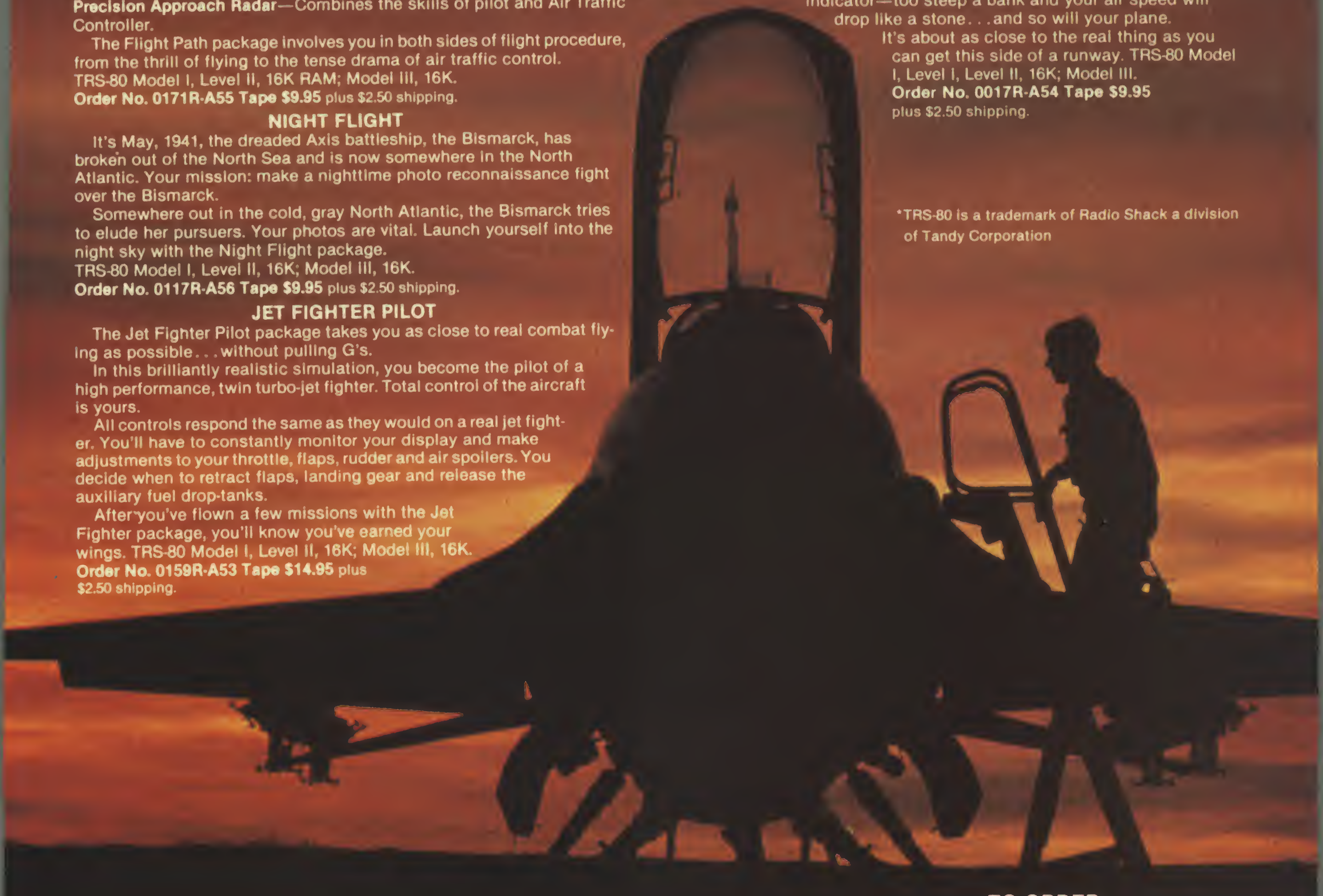

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LETTERS TO THE EDITOR

Five Volt Only

We oldtimers in electronics recognize the ±5 volt power supply designation as meaning a positive and a negative power supply, or a total potential difference of 10 volts.

I have used the 6845 mentioned in Joe Martinka's "Videographic" article (Aug. 1981, p. 60), and this chip is a "five volt only" integrated circuit. This minor error will not bother the experienced builder one bit but it may make things more difficult than necessary for the newcomer.

George Young
Tollhouse, CA

Lowercase Mod

The April 1980 issue of *Microcomputing* ("Lowercase for the TRS-80," Steven Wexler, p.132) has a lowercase mod for the Model I. I think this is a great mod and I have been using it since the article appeared and have not had any problems with it. NEWDOS 80's LCDVR works fine with it and so do all the other drivers I have used. That is, until I recently purchased DOSPLUS 3.3D. Its automatic lowercase mod detector does not recognize this mod. So I dug into the code and offer this patch to anyone who may have the same problem: Execute the system's Diskzap program. Display Track F, Sector C. Then find on the fifth line the code 2806. Enter the modify mode and zero these two bytes. That's all. Boot the system and you should have lowercase. This patch effectively bypasses the detector and enables the lowercase driver regardless of the hardware.

Truman Krumholz
Springfield, MO

Less Traumatic for Your Apple

The article in the August 1981 issue of *Microcomputing*, "Apple to Selectric for 83 Cents," looks like a good way to beat the high cost of interface boards.

I found a much less traumatic way to hook everything up. Get a 16-pin DIP socket with long leads such as a wire-wrap type. Trim them about 1/16-inch longer than the leads on your paddle. Next, tack solder small-gauge wire (such as wire-wrap wire) to pins 9 and 16 of the socket. Make neat solder connections very close to the socket base leaving most of the leads free of solder. Make sure there are no shorts. The pins should be straight and filed smooth on the ends. Plug this socket into the game paddle socket. If you have any peripheral cards (I used my disk card in slot 6), the rest is easy. Carefully count the pin slots and trace the printed circuit lands that connect to pins 33 and 50 of the slot connector. At the first solder blob of each land, connect the wires—33 to paddle pin 9, 50 to paddle pin 16. Now you can build and plug in the interface circuit as shown in the article. (I believe the required transistor is npn, not pnp as drawn in the schematic.)

If you have no cards, perhaps you can make a dummy card out of instant stick pc foil and the right sized piece of perf board—or etch you own pc board.

This is a fast method that makes no permanent changes in your Apple. I haven't gotten a Selectric yet, but if I do you can bet I will try this.

Dorrance Rigney
Chelan, WA

In Defense of the IEEE-488 Bus

Mr. Briggs' comments (August 1981) on the appropriateness of the IEEE-488 bus for low-cost microcomputer hardware are somewhat off base. The following manufacturers support the IEEE-488 bus for microcomputers:

- Commodore—computers, disk drives, printers, modems
- SSM—Apple to IEEE-488 interfaces
- California Computer Systems—ditto
- D & W Digital—S-100 to IEEE-488 interface
- Scientific Engineering Laboratories—TRS-80 to IEEE-488 interface
- Base Two—printers (with RS-232, Centronics, and IEEE-488 interfaces included, not optional)

There are many other manufacturers of devices which support this bus, including Hewlett-Packard (manufacturer of the system Mr. Briggs says is more attractive than the Osborne), Wang, Tektronix, Livermore Data, Fluke and Racal.

While not the most popular communications protocol, the IEEE-488 bus does have broad-based support. The bus supports intelligent devices, spooling (peripheral to peripheral communications without central processor intervention), and multiple devices (up to 15) on a single I/O port. As the computing power of peripheral devices increases, the value of the IEEE-488 bus becomes more apparent; and it is available for the three most popular microcomputer systems in the U.S. at very little cost (in the case of Commodore computers at no extra cost).

P. J. Rovero
San Francisco, CA

I appreciated Mr. Briggs' comments (Letters to the Editor, August 1981) on both Mr. Osborne and the Osborne I, but I must take exception to his comments on the IEEE-488 (GP-IB). Although true that the de facto standard for printer interface has been the Centronics parallel, Mr. Osborne should receive a plus on his score sheet for including the GP-IB in his design. Mr. Briggs is certainly correct in stating that the GP-IB initially got its start through industrial use in instrument control/measurement systems. However, the GP-IB has become a *standard* for peripheral interface (printers, plotters, floppy, hard disk, 9-track tape) with the giants such as HP, Tek and Fluke. DEC and Data General also have GP-IB interfaces for their mainframes. Yes, even Epson and (soon) Zenith offer IEEE-488 interfaces. There are several S-100 to GP-IB cards available (some not very good). In fact, N.H. Research (Irvine, CA) manufactures a dual GP-IB on a single card and has added four dozen verbs to Microsoft BASIC for their product (unfortunately this card is not available without purchasing their system). Cost of the IEEE-488 is set by the marketplace and not necessarily by hardware design. The RS-232 interface is more costly than the GP-IB for the Epson printer and yet the design of the GP-IB is more complicated.

Mr. Briggs needs to reevaluate the GP-IB interface because computers that don't offer GP-IB in the future will suffer in terms of sales.

Robert H. Stratton
Advanced Digital Group Inc.
Garden Grove, CA

The STD Bus Debate

Mr. Langford's article on the STD bus ("The STD Bus is Coming," August 1981, p.226) is generally accurate. There are, however, over 50 manufacturers of STD products and CPU support that include the 8088. The marketplace is very clearly defined as process/control catering to the OEM and not the hobbyist. The target is Intel and the STD is a cost effective alternative to their large boards. The STD will not replace the S-100 (now that there is some standardization) simply because there is a marketplace for the larger sized cards. This marketplace, however, is shifting to the professional side rather than the hobbyist.

I'm very disappointed that one of the major manufacturers, and the *original* designer/user of the STD, was left off the company list. That company is: Pro-Log Corp., 2411 Garden Road, Monterey, CA 93940 (408-372-4593).

Robert H. Stratton
Advanced Digital Group Inc.
Garden Grove, CA

(continued on page 211)

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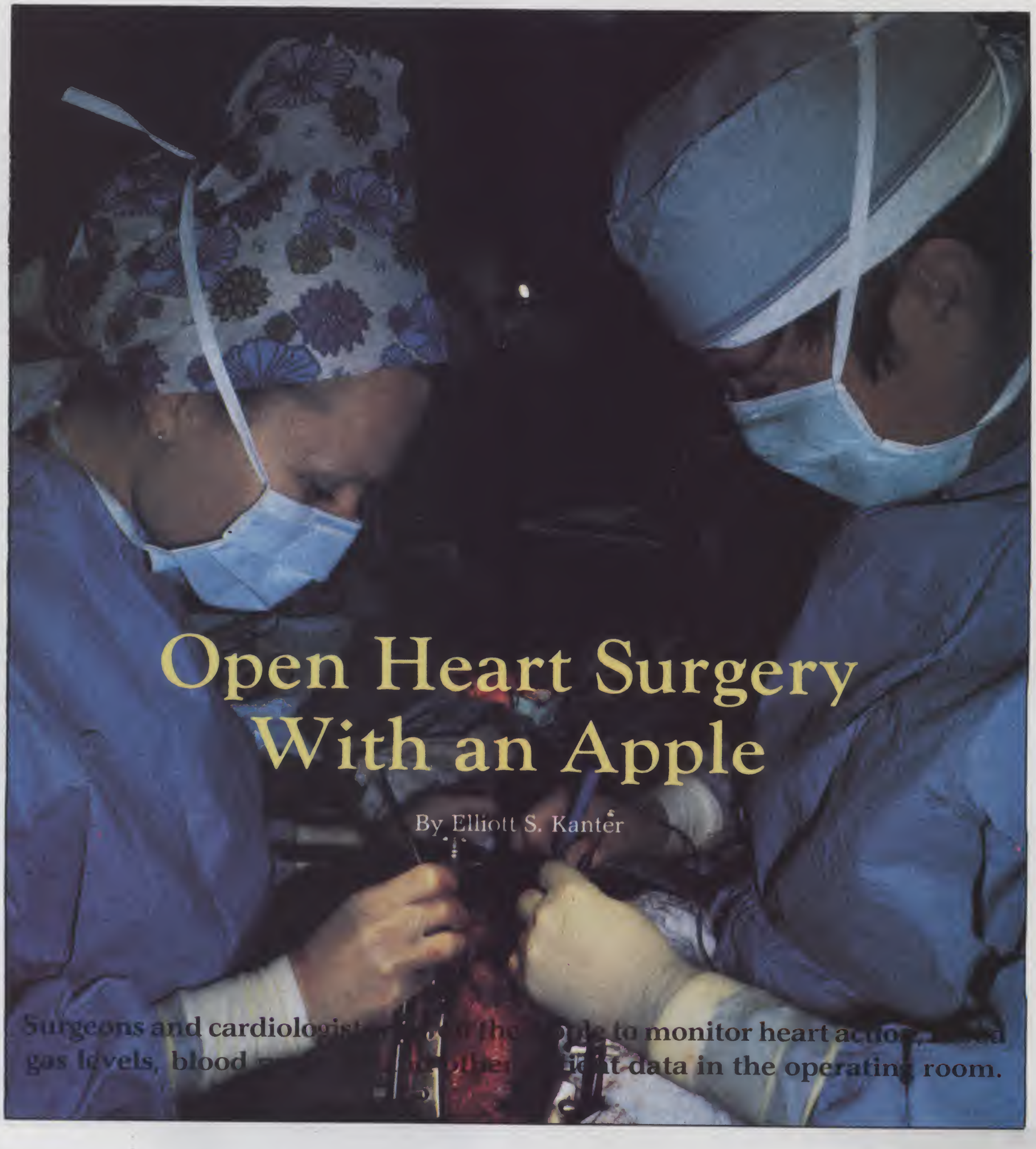


Open Heart Surgery With an Apple

By Elliott S. Kanter

Surgeons and cardiologists use the Apple to monitor heart action, blood gas levels, blood pressures and other patient data in the operating room.

Hospitals and computers have been working together for some time. But when Memorial Hospital decided to send an Apple computer into open heart surgery, it represented quite a departure from our conventional procedures.

Memorial is a private, 205-bed hospital in Daytona Beach, FL. For eight years, we've been gradually adding resources that let us diagnose and treat cardiovascular illnesses. This process culminated in 1980 with our approval as a surgical center, the last such center to be certified for the State of Florida.

When I joined the hospital, I became involved in meeting the technological requirements of the surgeon and the cardiologist. Our equipment included a dedicated computer system which, according to its manufacturer, provided a variety of real-time data to the surgeon during surgery. The sorts of information this computer was designed to provide included representations of waveforms (blood pressures, ECG [heart action]), real-time updates of vital blood gas test information and a variety of calculations based on information furnished by the monitors.

The system took data from several sources as diagrammed in Fig. 1, processed it and displayed it on two large

Elliott S. Kanter is the director of biomedical engineering at Memorial Hospital, 875 Sterthaus Ave., Ormond Beach, FL 32074.

CRT displays in the operating room.

Some of the data was immediately and locally obtained from analog and digital outputs to the monitors. But other information was entered by a technician. For example, blood samples were drawn, sent to the remote (some 170 feet distant) cardiopulmonary lab and processed by a computer-enhanced analyzer; the results were then typed into the computer system for display in the operating room. Both locations were able to communicate on a minimum level through the computer via two separate keyboards.

Medical applications of electronics are just like any other: if something can go wrong, it will. In our case, we rapidly learned that our $30,000 computer system was not capable of doing either what the surgeon required or what the manufacturer had promised.

Our problems were further complicated by irregularities in our power supply. Floridians have a nickname for the power company that has to do with the words flicker and flash. The open-heart computer couldn't tolerate these brief episodic flickers, and frequently crashed. Although at no time was a patient's welfare jeopardized, we decided that the system was not reliable enough. We determined to either improve or replace the existing computer system with something that was simple to use, reliable under power fluctuations, cost-effective and able to do other tasks.

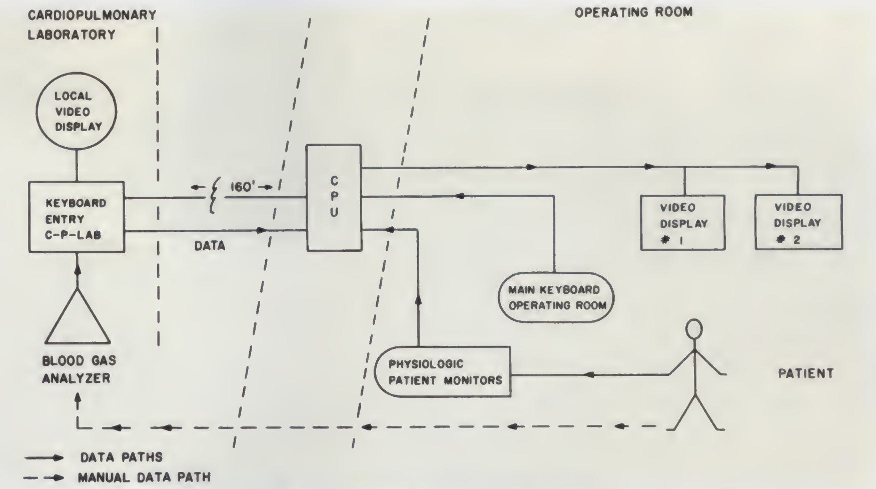


Fig. 1. Original system configuration.

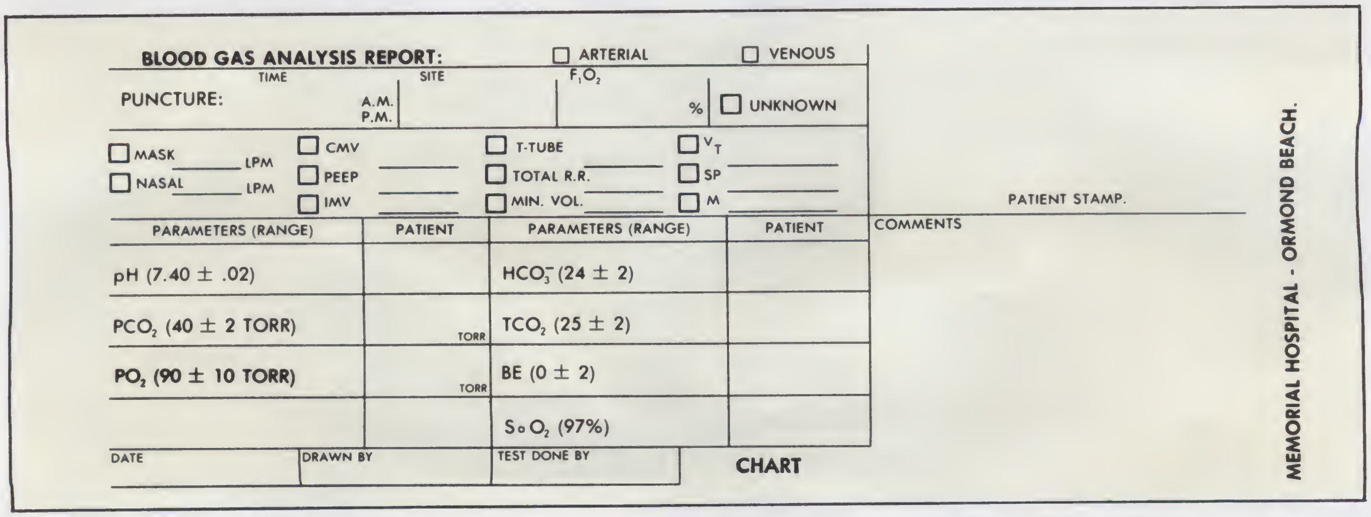
Choosing a Micro

We examined our present system, and decided that the channel of information between the cardiopulmonary laboratory and the operating room—which provided the results of periodic blood tests to determine the concentrations of oxygen, CO_2 and other medically-related parameters—was of primary import. The rest of the information, while nice to have, could be obtained manually nearly as fast, and with less clutter and complexity in an already-complex and cluttered operating room. With the hospital's director of information sciences, we determined that a microcomputer would fill our initial needs, and be able to handle future requirements.

Next we had to pick the equipment and a vendor. The system had to be available off-the-shelf, with support and assistance from the vendor, when we changed from one system to the other. It came down to the Apple and the Radio Shack TRS-80. We learned that no TRS-80s were available, but our local Apple dealer had both systems and system-assistance.

One fact was apparent to us from an administrative, technical and medical viewpoint. The vendor had to offer a complete service, not just a microcomputer in a factory-sealed box. Without a continuing relationship and available support, the microcomputer would soon become more of a hindrance than a help. No software is 100 percent adaptable to all applications. We were lucky: our vendor was able to provide both the product and service.

A number of questions and details remained to be resolved. We set up a meeting between representatives of the hospital administration, bio-medical engineering, the vendor and our perfusionist, Mary Willis. Willis' input and suggestions were particularly important: she operates the heart-lung bypass machine, and needs the data from the blood gas samples. During open-heart surgery, the patient's heart is actually stopped, and clear tubing links Willis' machine with the major blood vessels of the patient's circulatory system; the machine sup-



BLOOD GAS ANALYSIS REPORT: ☐ ARTERIAL ☐ VENOUS

PUNCTURE: TIME A.M. P.M. SITE F_IO_2 % ☐ UNKNOWN

☐ MASK ______ LPM ☐ CMV ______ ☐ T-TUBE ☐ V_T ______
☐ NASAL ______ LPM ☐ PEEP ______ ☐ TOTAL R.R. ______ ☐ SP ______
☐ IMV ______ ☐ MIN. VOL. ______ ☐ M ______

PATIENT STAMP.

PARAMETERS (RANGE)	PATIENT	PARAMETERS (RANGE)	PATIENT	COMMENTS
pH (7.40 ± .02)		HCO_3^- (24 ± 2)		
PCO_2 (40 ± 2 TORR)	TORR	TCO_2 (25 ± 2)		
PO_2 (90 ± 10 TORR)	TORR	BE (0 ± 2)		
		S_aO_2 (97%)		

DATE	DRAWN BY	TEST DONE BY	CHART

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Fig. 2. Blood gas report form.

The surgical team in action in the operating room.

plies oxygenated blood throughout surgery. Typical pump runs are around two and a half hours, and constant adjustments must be made.

Also present was a member of our cardiopulmonary department to help define the format of the data, the types of data inputs and levels of operator expertise. It was essential that the system be easy to operate, with a minimum of specialized codes or instructions.

Data formatting, or the manner in which data was to be presented, was important. Each of the basic parameters was present in two distinctive tests, the venous and arterial sampling modes. It was critical to be able to immediately tell which was which; a mistake could materially affect the patient undergoing surgery. We experimented with a number of approaches and variations, before settling on a single standard format.

Command	Activity
/CLEAR	Clears screen for new patient
/B	Rings bell
/Jx	Jump cursor to specific location (x) 1 to 4
/C	Clears current area cursor is in
/.	Clears the specific field
/	Back one display
RETURN	Advance to next display

Table 1. Program instructions.

J1	Arterial
J2	Venous
J3	REM (remarks)
J4	Other lab data

Table 2. Screen locations.

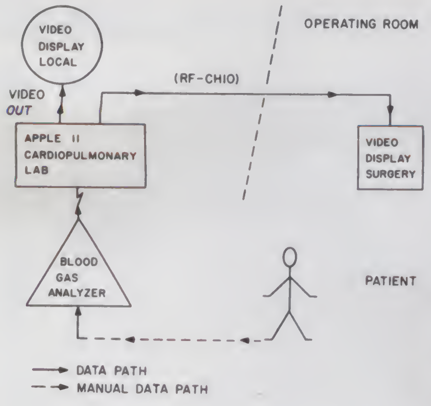
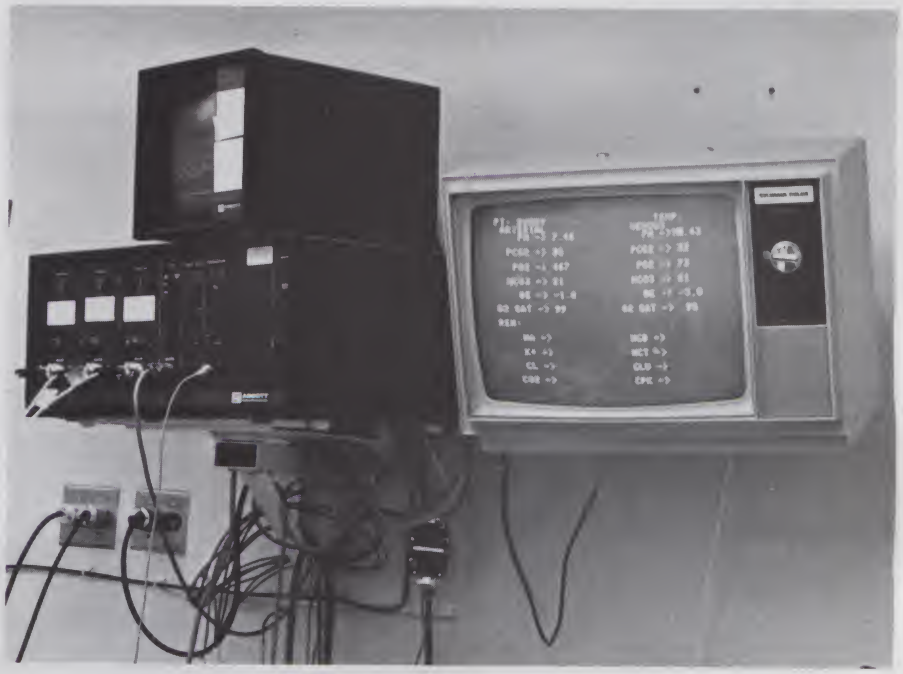


Fig. 3. Apple system configuration.



The monitor system and video display in the open heart surgical suite.

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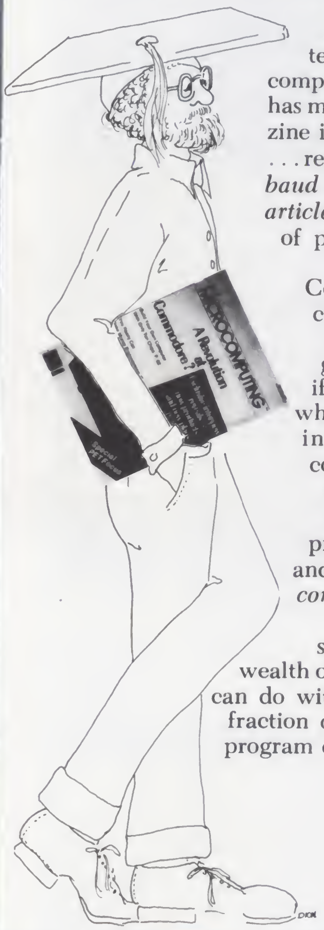

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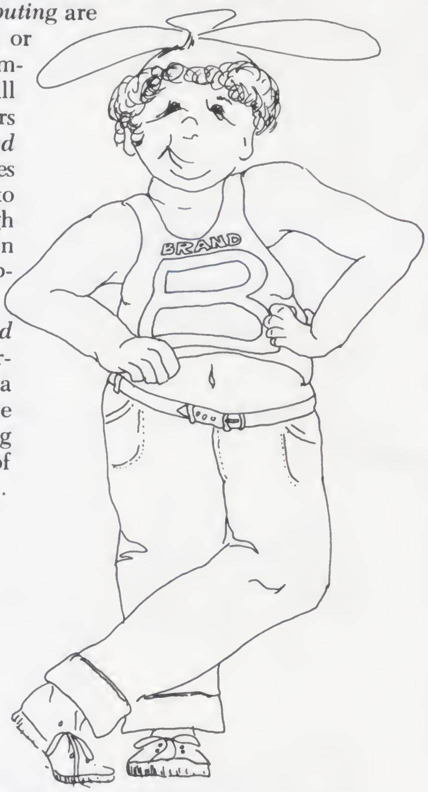

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This format in many ways closely resembles Fig. 2, the standard blood gas analysis report form.

The vendor made several versions of a proposed program, leading to the one that has been used daily since October 1980. The program is loaded into the computer each morning via cassette and updated throughout the case by a cardiopulmonary technologist.

The System

Our system consists of an Apple II with 32K RAM, a nine-inch video monitor and a 19-inch TV in the operating room. The data uses the Apple's ability to support both video and the internal rf modulator operating on VHF channel 10. Fig. 3 details the actual signal paths and configuration. We have deleted the two-way communications capability from the operating room to the blood gas lab, but have added reliability and simplicity to the system.

The Apple has proven itself able to operate through power fluctuations with nary a glitch or dropped bit. In fact, the only reported problem has been due to an operator leaning across the keyboard, which generated random and meaningless data on the video monitor and the slave TV.

The system as configured might seem like technological overkill, in that we are using a fraction of the memory. But we ordered the additional memory to let the Apple take on extra work. These additional tasks will include direct data input and processing from the physiological monitors, specific cardiovascular studies and profiles and patient data management.

Conclusions

The acquisition of our microcomputer was an education. We went from a highly-advertised yet poorly-conceived and executed $30,000 computer system to a simple, reliable and expandable microcomputer system which cost less than $1600. We have found that we can peacefully coexist with a microcomputer system, and Apple has found itself a place on our open-heart surgical team.

I've included the complete program listing so that other hospitals can use the Apple in their own surgical settings. Any questions concerning the program or its operation should include a self-addressed stamped envelope.■

Cardiopulmonary technologist enters the results of a blood gas analysis into the Apple and the results appear both on her monitor and in the operating room.

Program listing.

```
]
]   PATIENT DATA SYSTEM FOR APPLE II
]   (C) 1981 MEMORIAL HOSPITAL, 875 STERTHAUS AVE. ORMOND BEACH FL 32074
]
]
]
]LIST
1  DIM H1$(30),R$(30),V(30),H(30)
    ,L(30)
10 E = 24
20  GOSUB 3000
40  HOME
45  POKE 34,24
100  HOME : FOR L = 0 TO E
110  VTAB V(L): HTAB H(L)
120  PRINT H1$(L);R$(L)
130  NEXT L
1000  REM  CONTROL OF CURSOR BLOC
     K
1001  IF I = 2 THEN I = 4
1002  IF I = 3 THEN I = 1
1010  IF I > E THEN  PRINT "";:I =
     0
1012  IF I < 0 THEN  PRINT "";:I =
     E
1100  VTAB V(I): HTAB (H(I) +  LEN
     (H1$(I)) - 1): INPUT A$
1110  IF A$ = "" THEN I = I + 1: GOTO
     100
1120  IF A$ = "/" THEN I = I - 1:
      GOTO 100
1130  IF A$ = "/CLEAR" THEN  FOR
     C = 1 TO E:R$(C) = "          "
     : NEXT C:I = 0:R$(0) = "
                                "; GOTO
     100
1135  IF A$ = "/." AND I = 16 THEN
     R$(16) = "
```

More

Program continued.

```
          ":I = I + 1: GOTO 100
1140  IF A$ = "/." THEN R$(I) = "
           ":A$ = "":I = I + 1: GOTO
     100
1150  IF A$ = "/C" THEN  GOTO 200
     0
1160  IF  LEFT$ (A$,2) = "/J" THEN
      GOTO 2500
1210  IF  LEN (A$) > L(I) THEN A$
      =  LEFT$ (A$,L(I))
1240 R$(I) = A$:I = I + 1: GOTO 1
     00
2000  IF I < 10 AND I > 3 THEN  FOR
     Q = 4 TO 9:R$(Q) = "        "
     : NEXT Q:I = 4: GOTO 100
2100  IF I < 16 AND I > 9 THEN  FOR
     Q = 10 TO 15:R$(Q) = "
      ": NEXT Q:I = 10: GOTO 100
2200  IF I < 21 AND I > 15 THEN  FOR
     Q = 16 TO 20:R$(Q) = "
      ": NEXT Q:R$(16) = "



          ":I = 16: GOTO 100
2300  IF I > 20 THEN  FOR Q = 21 TO
     E:R$(Q) = "          ":I = 21: GOTO
     100
2400  GOTO 100
2500  IF  MID$ (A$,3,1) = "1" THEN
     I = 4: GOTO 100
2510  IF  MID$ (A$,3,1) = "2" THEN
     I = 10: GOTO 100
2520  IF  MID$ (A$,3,1) = "3" THEN
     I = 16: GOTO 100
2530  IF  MID$ (A$,3,1) = "4" THEN
     I = 21: GOTO 100
2599  GOTO 100
3000  REM  SET SCREEN DYSPLAYS
3010 H1$(0) = "PT -> "
3011 H1$(1) = "TEMP-> "
3012 H1$(2) = "A R T E R I A L"
3013 H1$(3) = "V E N O U S"
3014 H1$(4) = "    PH -> "
3015 H1$(5) = "  PCO2 -> "
3016 H1$(6) = "   PO2 -> "
3017 H1$(7) = "  HCO3 -> "
3018 H1$(8) = "    BE -> "
3019 H1$(9) = "O2 SAT -> "
3020 H1$(10) = "    PH -> "
3021 H1$(11) = "  PCO2 -> "
3022 H1$(12) = "   PO2 -> "
3023 H1$(13) = "  HCO3 -> "
3024 H1$(14) = "    BE -> "
3025 H1$(15) = "O2 SAT -> "
3026 H1$(16) = "REMARKS: "
3027 H1$(17) = "    NA -> "
3028 H1$(18) = "    K+ -> "
3029 H1$(19) = "    CL -> "
3030 H1$(20) = "   CO2 -> "
3031 H1$(21) = "   HGB -> "
3032 H1$(22) = "   HCT -> "
3033 H1$(23) = "   GLU -> "
3034 H1$(24) = "   CPK -> "
3090  FOR Q = 1 TO 10:SP$ = SP$ +
      CHR$ (95): NEXT :ZR$ = "000
     0000000"
3100 V(0) = 1:H(0) = 1:L(0) = 25
3101 V(1) = 2:H(1) = 1:L(1) = 5
3102 V(2) = 4:H(2) = 1:L(2) = 0
3103 V(3) = 4:H(3) = 20:L(3) = 0
3104 V(4) = 6:H(4) = 1:L(4) = 7
3105 V(5) = 8:H(5) = 1:L(5) = 7
3106 V(6) = 10:H(6) = 1:L(6) = 7
3107 V(7) = 12:H(7) = 1:L(7) = 7
3108 V(8) = 14:H(8) = 1:L(8) = 7
3109 V(9) = 16:H(9) = 1:L(9) = 7
3110 V(10) = 6:H(10) = 21:L(10) =
     7
3111 V(11) = 8:H(11) = 21:L(11) =
     7
3112 V(12) = 10:H(12) = 21:L(12) =
     7
3113 V(13) = 12:H(13) = 21:L(13) =
     7
3114 V(14) = 14:H(14) = 21:L(14) =
     7
3115 V(15) = 16:H(15) = 21:L(15) =
     7
3116 V(16) = 18:H(16) = 1:L(16) =
     69
3117 V(17) = 20:H(17) = 1:L(17) =
     7
3118 V(18) = 21:H(18) = 1:L(18) =
     7
3119 V(19) = 22:H(19) = 1:L(19) =
     7
3120 V(20) = 23:H(20) = 1:L(20) =
     7
3121 V(21) = 20:H(21) = 21:L(21) =
     7
3122 V(22) = 21:H(22) = 21:L(22) =
     7
3123 V(23) = 22:H(23) = 21:L(23) =
     7
3124 V(24) = 23:H(24) = 21:L(24) =
     7
3200  FOR Q = 0 TO E:R$(Q) = "
          ": NEXT Q:R$(0) = "
                           "
3499  RETURN
```

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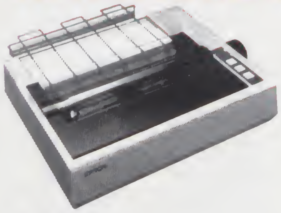

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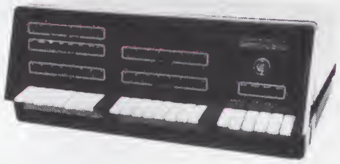

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When shuffling through mounds of paperwork became too much of a pain to bear, this doctor found the cure in microcomputers.

Just What the Doctor Ordered

By W.J. Blight

Over the past few years, an increasing amount of office overhead has been directly related to staff salaries. Small medical offices have done little to automate, as other businesses have. Our office reached the paperwork overload in 1978. I decided to take the plunge, and leased an Alpha Micro system with four floppy disk drives and an Intertube terminal and Superterm printer.

I didn't start out thinking in terms of micros. I thought at first that the project would be a larger experiment, and that the programming costs alone would reach $45,000. I even applied to the National Health and Welfare office in Ottawa for a grant. But when I realized that a microcomputer might be able to do the job, the project seemed more manageable. So I struck out on my own to investigate the possibilities.

Too Many Cards

Physicians in Canada face several problems unique to this country.

First, Canada has a universal health care system. All bills are paid by the government on behalf of the individual patients. Billing in Manitoba is done to the Manitoba Health Services Commission (MHSC) through an IBM-type claim card, which can be optically scanned for information. This card must be filled out by the office staff and signed by the doctor for each patient visit to the office. These cards are then sent periodically to the Commission for payment, and payment to the doctors is made every two weeks, usually about four weeks after the patient's visit.

Doctors can bill patients privately, but must do so for all patients. A few specialists have opted out of the plan, while family physicians have stayed in the plan. In Manitoba only about 6 percent of all physicians have opted out.

Handling the Commission's cards is a big problem. About 60 cards are required each day from the two doctors in our office. This time-consuming job requires us to type repetitious demographic data on each card—patient's name, address, month and year of birth, etc. Frequent mistakes are made, usually by not recording the day of the visit or by typing a mistake in the date or the patient's health services number.

Another problem is with the ratification of the cards submitted. Some 450 to 500 cards are sent to the commission for each two-week period. When done manually, cards are provided in duplicate, the duplicate card being kept for ratification. They tend to be stored in the order in which the patients came in the office, but the listing of payments as returned by the MHSC comes for each doctor with the patients listed in alphabetical order.

Preliminaries

My practice has been located in a suburb of Winnipeg since 1962. I started as a solo practitioner, and later entered into a two-doctor partnership.

The clinic area is composed of five examination rooms, a small laboratory, general office and waiting room. The staff consists of a registered technologist and a licensed practical nurse. The LPN does the office work, along with such patient care as giving shots, putting on dressings and giving ultra sound treatments. The technologist spends about 75 percent of her time doing laboratory work, and the rest with general duties.

We also employed a typist and general office assistant, who worked about ten hours a week.

We see from 50 to 70 patients a day.

When I decided that automation would be an interesting and useful project, I felt that much programming would be needed to do patients' medical histories.

I applied to the NHW for a grant, but was turned down. Then I realized

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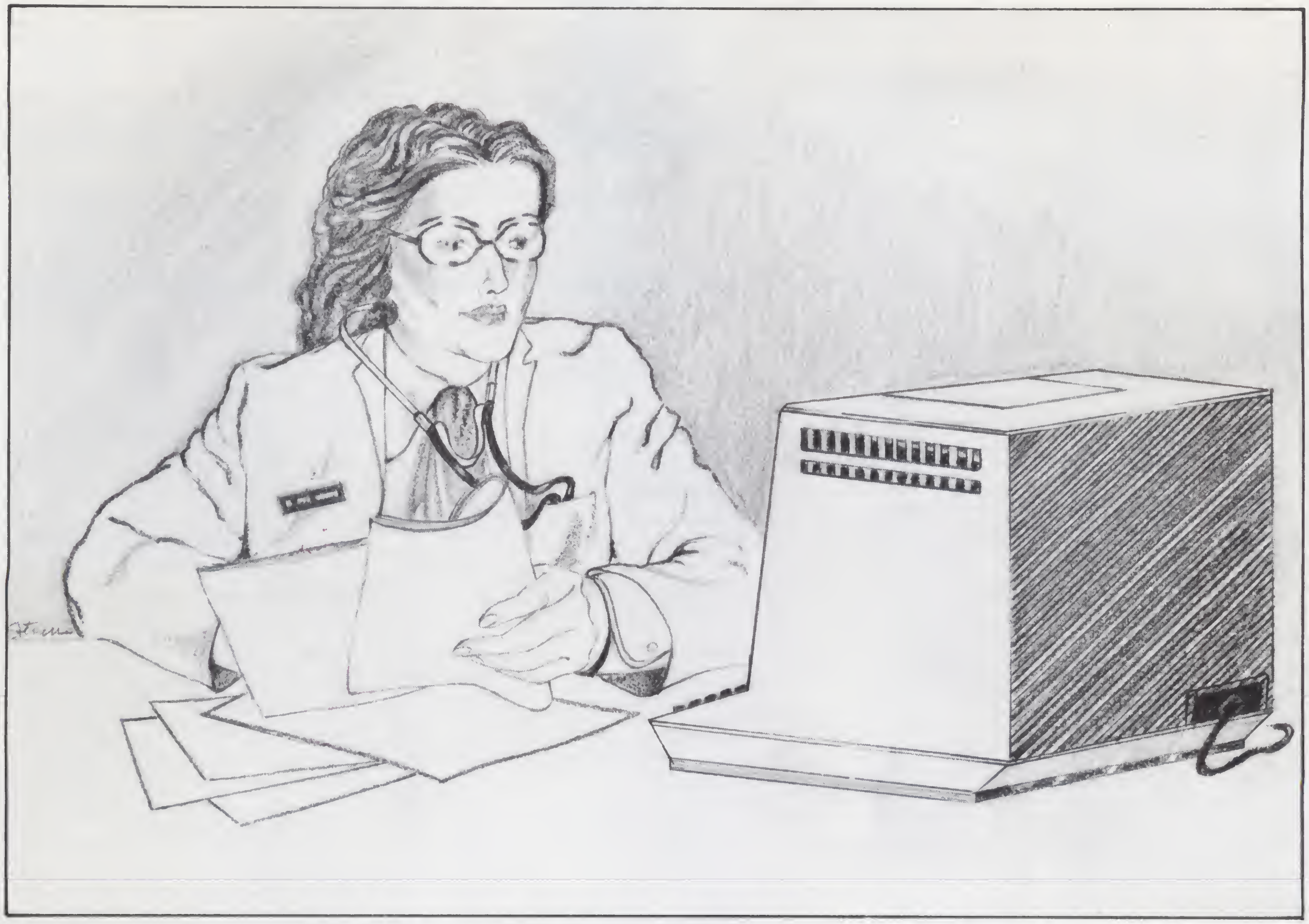
Address correspondence to W.J. Blight, M.D., C.C. F.P., Maginot Medical Centre, 690 Elizabeth Road, Winnipeg, Manitoba, Canada R2J 1A4.



that microcomputers might be an answer, in which case I could start on my own.

I approached the Manitoba Health Services Commission, the paying agency in the province, to find out what criteria would have to be met if I implemented such an automated system. They were adamant that the present claim cards would have to be used. But they were willing to provide cards which could be handled by a printer automatically. Also, they would accept a computer signature on the cards.

We looked at two systems to provide printing. The first system, by IBM or Xerox, used a magnetic card typewriter. But we estimated that on a three-year basis, the cards would cost twice what a typewriter would. This led us to consider a microcomputer. A Byte Shop opened in Winnipeg, and I began to visit it, talking with them about the equipment they handled, and the capabilities of the machines being marketed.

First I had to know what information I needed to store on each patient. The minimum was the amount necessary to fill out the MHSC claim card. I also wanted the middle name and the home and work phone numbers, and the first name of the head of the household. To access each record quickly, we would use a clinic number, to be given to each patient as their files were entered.

The data saved on each patient at this time was:

Last name
First name
Second name
First name of head of household
Address
City
Province
Postal code
Day, month and year of birth
Sex
Marital status
Home phone number
Office phone number
Manitoba Health Services number
Clinic number

We required 120 bytes per patient to store this amount of information. We needed enough storage space for 2500 patients per doctor per year, and space for new patients.

Machines using tape as the main storage were too slow. Floppy disks were starting to appear, and my impression was that an eight-inch disk would store about 2000 patients; four drives would be enough for several years. However, I knew that I would eventually have to use a hard disk.

A further consideration was service. No matter how sound the equipment, it would sooner or later require servicing. Many American-made computers would have to be sent back to the States through customs, which for all practical purposes was out of the question. We thus needed a Canadian dealer, preferably in Winnipeg, with local repair possible.

Initially only two systems looked at all possible: the Heath H11, which is based on DEC (Digital Equipment Corporation) equipment, and an Ohio Scientific. The Heath appeared to be adequate, but there were no floppy drives available, let alone hard disk.

Ohio Scientific took five months to send their material; this led me to conclude that they and their Canadian distributor would be unacceptable to deal with.

Enter Alpha

In the interval, a few journals made

references to a company called Alpha Micro. I wrote them, and they put me in touch with a person who had just started to establish an Alpha dealership in Winnipeg. A demonstration of the machine and its capabilities followed, and I decided to buy it.

In mid-December of 1978 I received the first parts of the system and started learning the BASIC language. I decided that the best way to learn programming was to write enough of a program to be able to start using the equipment in the office. By Jan. 3, 1979, this initial program, although rudimentary, was working, and the equipment was in the office.

This first program entered the patient data into the file,and printed out the card to the Commission, with at least the patient's demographic data and the date on the card. The first few weeks were hectic, but by the third week the office staff noticed a reduction in the time necessary to print the cards.

Both the laboratory technician and the LPN learned quickly to operate the equipment. The program displayed instructions on the screen and we had few problems. One nice feature of doing the programming yourself is that if a step is not clear to the staff, they soon let you know. The staff soon named the computer FRED, which stands for:

Frankly
Ridiculous
Electronic
Device

> The program displayed instructions on the screen and we had few problems.

In March a new doctor came to work with me, and it became necessary to have cards printed for him. Along with this was needed another day book entry. This was the next addition.

With the day book, we realized that if we saved the data on our patients, and then typed them out alphabetically at the end of each pay period, we could quickly ratify the listing of payments as sent out by the Manitoba Health Services Commission.

Presently card preparation took about 20 minutes each morning. This freed our LPN to do other work in the office.

We soon found one other use: letter-writing. A reasonably good text formatting program comes with the computer. The time spent on letters has been cut in half.

Benefits we now enjoy include the virtual elimination of improperly filled out cards from the Manitoba Health Services Commission. Once the initial data is entered, it is always reentered correctly on subsequent visits. The date of visit is automatically entered by the computer, and can never be forgotten.

We decided to expand to the hard disk after about nine months. Although the 10 megabyte Hawk drive of Control Data Corporation (CDC) was slightly cheaper, the drugstore in the shopping center was interested in computerizing, so we went with their 90 megabyte Phoenix. Part of the cost was offset by the drugstore's use of the system.

Problems

One of the first changes necessary came from the realization that entering the first name of the head of the household had been a mistake. In trying to build a possible billing system, this piece of information was useless; we needed to enter the clinic number of the head of the household. I therefore changed the program to have the clinic number entered. At the same time, I was able to shorten the number of bytes necessary to hold the information, leaving me with space for additions. I also realized that eventually we would need to purge the files. I incorporated the year that the file had last been accessed. One weekend after these changes were made, the computer read each old record and converted it into the new record.

We also found that the floppy disks were very unreliable. Several boxes of disks could not be used at all, and had to be returned. I found also that I was able to store only about 1200 patients per disk.

Backup was another problem. Be-

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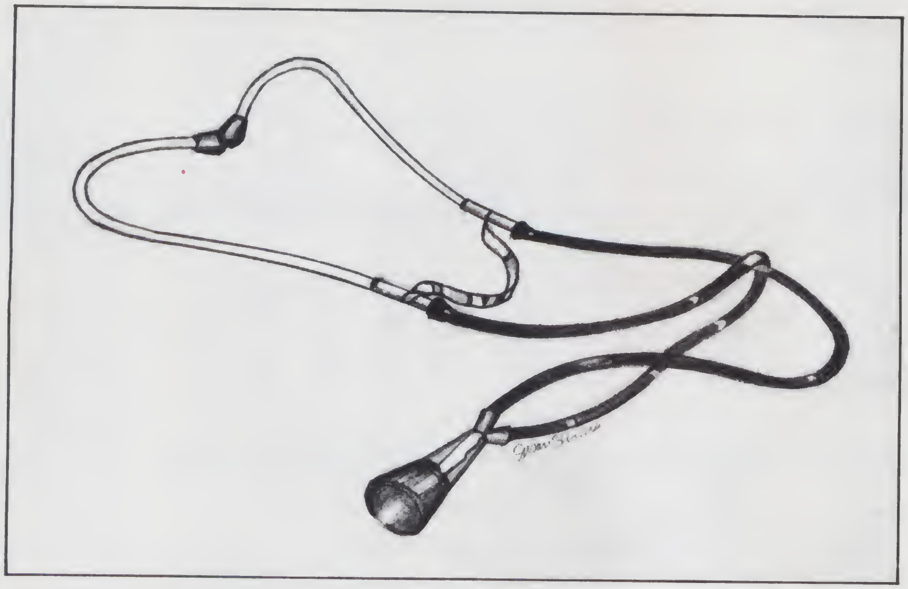

cause the floppies were so bad, I felt that I had to have at least two backup copies of each one. Each of the four disks required about five minutes to do each evening. The staff has enjoyed the hard disk for the ease of backing up the records.

The floppies were our only major equipment error. We should have gone for a small hard disk unit right from the start. The down time is slight, with one exception—we suffered a head crash after 13 months of operation.

The system ran for about 14 hours a day until November of 1979. Since that time it has been in use 24 hours a day. Other failures in that time have included three memory chips. Two of these took place within a few months of new boards being first operated, one in a board after two and a half years of operation.

One further deficiency has been in the printers. Superterm printers were bought for both my office and for the drugstore. After about a year, parts started to break. When we tried to obtain parts, we were told that the company was no longer making printers, had discontinued all parts for the ones that they had made, and had apparently no interest in helping to find parts necessary. In one case it took us three months to track down a chip. We've started to convert to Texas Instruments printers, and will try to keep one of the old ones running by using parts from the other one.

Another problem encountered was with the growth of the program. Each addition makes the program longer and more complex. Finally you either run out of internal memory, or you have to start splitting your programs into smaller segments and run them through a menu. Especially when working with floppies, this becomes very frustrating.

I started with a small program to print only the demographic data on the cards. As part of this I had to be able to enter and store all the pertinent information. Now, what happens if there is a typing mistake or the patient moves? You need a change program to change the data in the files. What happens if they move to another city? Make a deletion program. Now comes the request from the staff to have a day book. Okay, write a little program. Dr. X comes to the practice—change the program. Or I need a card for yesterday for this patient—change the program. Wouldn't it be nice to be able to look up the patient's records without knowing the full name, or the clinic number—a generic search program.

The power supply has been a major concern. Microcomputers are sold with the idea that they can run on the regular power supply as provided. Now I realize why there are so many ads in the magazines for power protectors. It becomes very frustrating when you have to press the reset button up to 12 times a day. We've tried to isolate some of these, some with success and some without. It is possible that some are due to other equipment within the shopping center. On investigating the power supply, we also found that all the grounds in the center were tied together. So we isolated the grounds to the computer, which helped considerably. One other answer was to put a choke in the computer to try to maintain the cycles at 60.

Due to our cold weather, interior car warmers are frequently installed, and the cars belonging to employees of the shopping center are plugged in during the day. On the very cold days, we still have a lot of trouble, possibly due to the overuse of these warmers.

One other interesting problem is the vacuum cleaner used in cleaning the office. It has created some rather weird problems; for instance, the computer has tried to call out on the phone line of the modem.

Confidentiality of Records

Much has been written in the past few years on the need for confidentiality of records. Most of the fears of doctors and other persons are for the potential abuse in large systems. If, for example, all patients in Manitoba had their records entered in one computer—for all reasons, including health and governmental agencies—health records might be accessed by people in other areas. Certainly by having many smaller computers scattered through the province, each with only parts of the total information, there is less chance of leakage.

In our computer and most others, password control can be or is built into the system. Each program or file is entered into the storage unit in blocked areas. Access to these areas is through entry of a password. Even within programs, passwords can be built in, so that individuals might be given access to certain parts of the records. Trust must still be placed in the individuals who have the ability to access the records, the same as is given to those with access to the paper records.

Further Development of the System

We've already started to use the computer for our general accounting. In a small office like ours, the programs necessary are very simple. I've written programs to do billing to insurance companies, record payment and do the general ledger. Checks are typed by the computer, with the recording of the check being carried out into the general ledger.

We anticipate that we should be able to put the entire patient record onto the computer, for easy retrieval of data, thus forming an automated record system. This would then allow use of the data in research into disease.

Discussions are currently going on

with the Manitoba Health Services Commission which will lead to trials of sending the information for billing to them over the phone lines, with the payment information in turn being sent to us by phone lines. Verification of claims paid could then be done automatically by the computer.

As we progressed to having the entire card filled out by the computer, we realized that a work sheet was needed. We prepared a two-part work sheet, the second sheet being the prescription pad. One danger of practice in the larger centers is of having prescription pads stolen, and prescriptions forged for drugs. This is no longer possible with our system, since the top of each prescription must be typed by the computer with the name and age of the patient, and the date seen.

At the end of 1979, I felt that it would be interesting to have an age-sex distribution on the patients seen. The program took about 30 minutes to write, and now takes about ten minutes to run at the end of each year.

The acceptance by the office staff has been great, the only question usually being "Why can't Fred. . .?" The important feature of use of developments in the office such as a computer must be in having the cooperation of the staff, in the planning of the move into the field, and their help in understanding why on occasion, with the introduction of a new program, it will "bomb."

One point must be emphasized—the programs in use now are all ones we developed. We've encountered some delays through programming errors, but these were anticipated by myself and the staff, and have not caused too much frustration. With a major change, we can always fall back on the old program, if the new one doesn't work right.

Conclusion

The use of a microcomputer in a two-doctor office appears to be cost justified, if it is added at a time when the office is considering new staff. In a larger office cost reductions can probably be achieved through the use of the computer and increased efficiency of the present staff.

Although few programs are yet available on the market in this field, more will arrive and the quality will increase. Hardware costs have been dropping at about 20 percent per year; this is likely to continue for some time. However, the cost of the programs is likely to increase as the salaries of the programmers increase.

Many articles on computerization, both in medicine and in general, have been saying that the technology is coming and we should be prepared to look at it. But the technology is here, the programs are available, and now is the time to consider office automation.■

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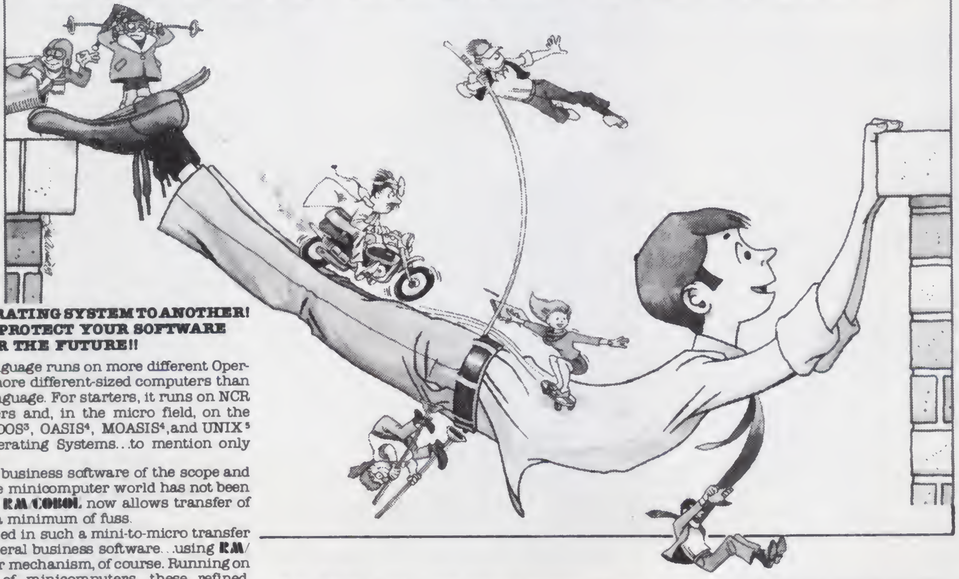

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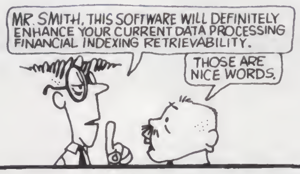
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Microsystems for the Dental/Medical Office

By E.J. Neiburger

When I began my dentistry practice in 1968, maintaining the office was a simple task. Insurance was not yet common—patients paid cash or made weekly payments. I had one staff member, who helped me at chairside, cleaned instruments, made appointments, wrote out bills (40 a month) and vacuumed the rugs. I practiced dentistry 90 percent of the time with a 70 percent profit/expense margin.

Thirteen years later, my staff is up to seven—most of whom push insurance forms (400 monthly) and billing statements. I practice dentistry 60 percent of the time, reserving the other 40 percent for red tape. My profit/expense margin has dropped to 47 percent.

My situation is not unique in medicine. While new technical developments allow great productivity, paperwork has grown exponentially. A family of four alone can require up to 48 insurance forms (preauthorization and billing forms in triplicate) for one office visit. Keeping track of payments, accounts receivable and unpaid bills takes up an increasing amount of time and expense.

These paperwork problems are aggravated by the fact that fees are often adjusted according to the income level of the patient. Furthermore, payment frequently involves a third party, such as an insurance company or welfare. Keeping track of these factors and educating the patient can be time-consuming and expensive.

Also, taxes and a host of federal, state and local regulations require the doctor to process increasingly more forms. Unemployment insurance, disability, workmen's compensation, payroll taxes—all contribute to mounds of extra paperwork and staff.

Apple II computer with large screen monitor and appointment program.

Most offices are quite efficient using manual methods—photocopy machines, pegboard logs, colored indexes and a reliable staff. But as the practice grows, the doctor must devote more and more time to management. At this point, it's time he consider computerizing his office.

Enter Apple II

After much shopping, we bought an Apple II with 32K bytes of memory. It took up little space and was quiet; it had sound, color, high-resolution graphics and a TV interface, and could be upgraded easily. It was also less expensive than other systems.

Eventually, we upgraded it to 48K bytes of programmable random-access memory (RAM) with one, and later two, disk drives. A year later we added a Corvus 10-megabyte hard disk system. We also switched from a low-resolution TV to a nine-inch, and then a 12-inch, monitor.

When loading times proved inconvenient, we bought several more Apples and dedicated them to different operations. This multiprocessing arrangement gave us minicomputer-like power at a fraction of the usual cost. We paid $13,700, while a comparable mini system—without such features as sound, color, graphics tablet, light pen and A/D board—would have run $50,000. We're now working on multiplexing the system, so that each computer can operate all peripherals independently. (See "Multiprocessor vs. Multitask" by Ken Barbier, June 1981 *Microcomputing*, p. 34.)

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The most important factor for any system is software. Fortunately, we've found some that meets our most critical needs.

The most time-consuming and costly portion of dental practice is handling insurance. We use an insurance form word processor called Dental Insurance Form Writer. It lets us edit and print master insurance forms for each family. As treatment progresses, services and fees are entered and insurance forms printed out on the same day. Lost forms (an epidemic on the increase at insurance companies) are no problem—a duplicate can be loaded from disk and printed with the touch of a key. Preauthorizations can be created and altered as treatment continues, and then printed and mailed.

This program helps reduce the cost of processing insurance forms from $1 (eight minutes of staff time) to 40 cents (three minutes) per form, and allows same-day submittals of forms. This reduces accounts receivable and speeds insurance payments to our patients. Before computers, we processed about 30 forms a day at a cost of $1 a form. We were usually three days behind. Computers reduced costs (after the debugging process) by about 60 percent, thus saving $3100 in labor per year. And mailings are done on the day of service, speeding up payments by one week.

In our credit economy, most patients want to be billed. Our old manual system took two staff members six hours each per month. Much of this time was spent computing interest charges on unpaid accounts. Interest Print, a short billing program, helped reduce billing time to four staff hours; it saves us $2500 per year in salaries and has lowered accounts receivable.

Most offices get along well with a simple appointment book and pencil. Problems occur when the daily appointment load exceeds 30 patients. Constant cancelling, rescheduling, erasing and searching for forgetful patients' appointment times result in delays, errors and over or underbooking. An out-of-control appointment book is a prime source of office stress.

Instead, we use the Appointments program, a user-definable program that converts the Apple into an electronic appointment book. Each patient is given a convenient time slot. Days can be scrolled backward and forward using the arrow keys. There are full editing functions, day sheet and printout modes. The search function allows rapid searches for appointments of forgetful patients.

The program has saved us at least two staff hours per day ($3600 per year), while controlling our appointments and giving us a steady patient load.

The most distressing problem encountered in the doctor's business office is misplaced records. The average dentist has 2000 active and 4000 inactive patients. Since each patient has an ever-increasing file, a tremendous volume of paper accumulates. Records must be pulled and refiled for each treatment and billing transaction. A misplaced file creates delays, lost insurance benefits and postponed treatment.

We use a patient-record program created from a database management program. Each patient record contains the following categories (fields):

- Name
- Address
- Phone
- Medical History
- Amount Owed
- Remarks

A patient's record can be created, edited or deleted. The entire file can be sorted alphabetically or searched by any field. Periodic searches for the field Amount Owed creates a billing or accounts-receivable file. It takes only a moment to retrieve a patient's phone number or print a mailing label or referral list.

This type of program can also be used with other lists. With a computer we can keep up to date with the 108 insurance carriers that serve our patients. Not only is it easier to educate our patients about their insurance benefits, but they feel they are obtaining the maximum benefits from their dental plans.

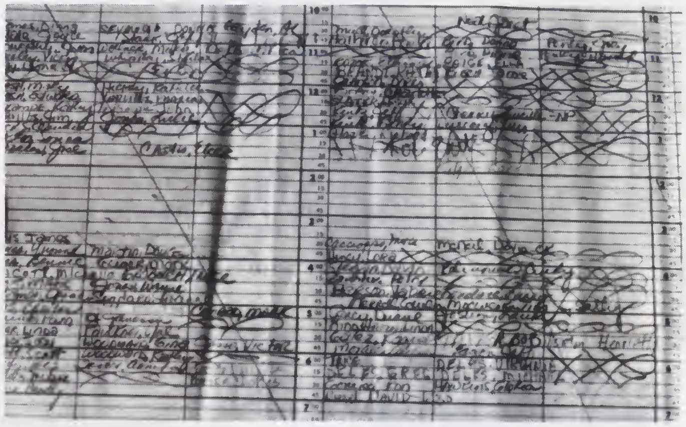
About ten years ago prevention became the watchword of dentistry (and medicine). The usual dental checkup is every six months and people tend to forget these long-term appointments. It is expensive and time consuming to search through card files and make up recall post cards.

A computerized recall file can be made from a database management program. It will automatically produce recall lists (name, address, phone) for those who are due for an exam and cleaning. Overdue individuals can be reminded of their visit. The recall file contains the fields:

- Name
- Address
- Phone
- Last Visit
- Next Visit
- Remarks

The program will select patients on the basis of the Next-Visit field. When setting up appointments for the next month, the system will sort and print a list of all people who should be seen. Labels are then printed and

Bulky paper patient files.



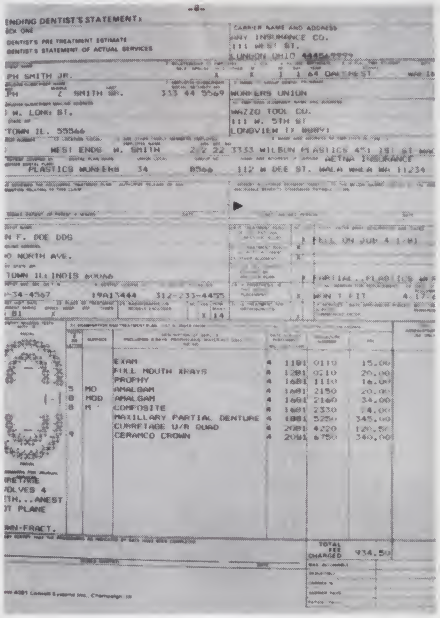
Appointment log—messy, crowded and hard to read.

placed on post cards. This process can save at least one hour of secretary time per day.

One of the first programs I used when I computerized was the word processor, Applewriter. The dental/medical office has ample need for personalized mass mailings. Collection letters, letters thanking individuals for referrals, welcome-to-our-practice letters and treatment instruction/information sheets aid in normal business activities. Reports to insurance companies as well as usual business communication to suppliers, labs and governmental agencies are also needed.

The amount of secretarial time saved and the improved public image created by original rather than photocopied form letters and information sheets make word processing essential for any office.

A program that will print labels is a small investment and a great convenience. With Label Writer, we print several batches of pressure-sensitive labels for each insurance company to which we submit forms. This saves one minute per letter, 40 letters per day. Labels with warning signs (allergy warning, medical alerts, credit status) are placed on the outside of patient records for rapid viewing. These and several other uses of printed labels can save the doctor's and secretary's time.


American Dental Association universal insurance form—almost an industry standard.

Other Computer Uses

- The computer need not lie idle at the end of the day. It can watch the office. The Apple Alarm program uses the Apple II's game paddle ports as inputs for floor mat and window alarms. The computer will register the times and activate alarms or a modem if the office is entered. (We now know what time the janitor works and when other employees arrive or leave the office.) Since several sensors must be triggered to activate the burglar alarm, there are no false alarms.

Patient/appointment records are the most valuable part of any practice. Their destruction by fire or theft can create a financial loss of disastrous proportions. Not only would the doctor lose valuable financial records, but the history of each patient's treatment and diagnostic tests would be compromised. Computers can make rapid backup copies on tape or floppy disk that can be kept off the premises for safety and duplication.

- The most common prescriptions written for dentistry are for antibiotics and pain medications in standard doses. It is helpful to have a small number of preprinted prescription forms for such medicines. Prescription Form Writer is a short program that creates any number of prescription forms. In the past we had a professional printer process several thousand prewritten forms; this was expensive and created a storage problem and theft risk. The program will print several dozen prescription forms on plain paper, when we need them and at a negligible cost.
- Super Checkbook is an excellent program that keeps track of our expenses (checks and deposits). It will keep a log of disbursements and income, and create reports of expenses by user-definable categories. Each month's expenses can be graphed and compared to preceding periods. This program very quickly allows you to see where your expenses are heading.
- Computing payroll for more than three employees takes time. A short payroll program that is upgradable (to new law requirements) and computes federal, state and Social Security taxes is helpful and saves several hours each month.
- There are several medical/dental computer bulletin boards (CBBSes)

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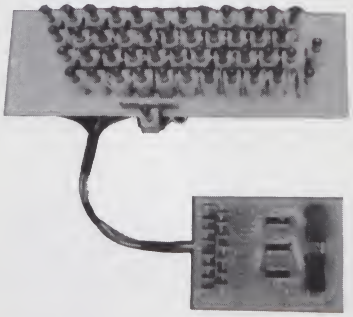

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by which you can "converse" with colleagues, using a modem and appropriate software. Also, over 300 general computer bulletin boards allow free access for information and advertising. New staff members, programmers and used equipment can often be located by use of CBBSes.

Service networks such as The Source or CompuServe supply a host of news, scientific and investment options for a small fee. Data on weather, news, nutrition analysis, food menus, banking, investments and precious-metal prices can be assessed.

Many insurance companies and suppliers are accepting modem-transferred insurance forms (e.g., Blue Cross). This speeds processing by avoiding the mail and key punching delays of manual forms. Treatment authorizations and billing, computer banking and other financial transactions speed payments and patients' treatment.

- Several programs will allow your computer to interpret lab reports, identify drug interactions and give differential diagnosis and prognosis statistics. The time-consuming calculations that a dentist must make from X-rays in order to plan orthodontic treatment can be quickly done using a graphics tablet.
- Patient education is an important aspect of prevention. Programs that teach the patient can aid the doctor in treatment. Heart Attack Test, Lifeline, Teeth and many other programs educate the patient about potential disease circumstances. The patient can learn about progressive gum disease or decay or how modification of life style affects longevity. Such programs allow the doctor to spend more time with the patients on treatment specifics and individual problems.

Professional education is also enhanced. The Millikin System is a series of 73 tutorial programs on various medical specialties. Encephalon by G. Banks uses graphics to simulate patient reaction during neurological examination. Control Data's new CP/M-based Micro System uses the extensive PLATO system library for general specialty training.

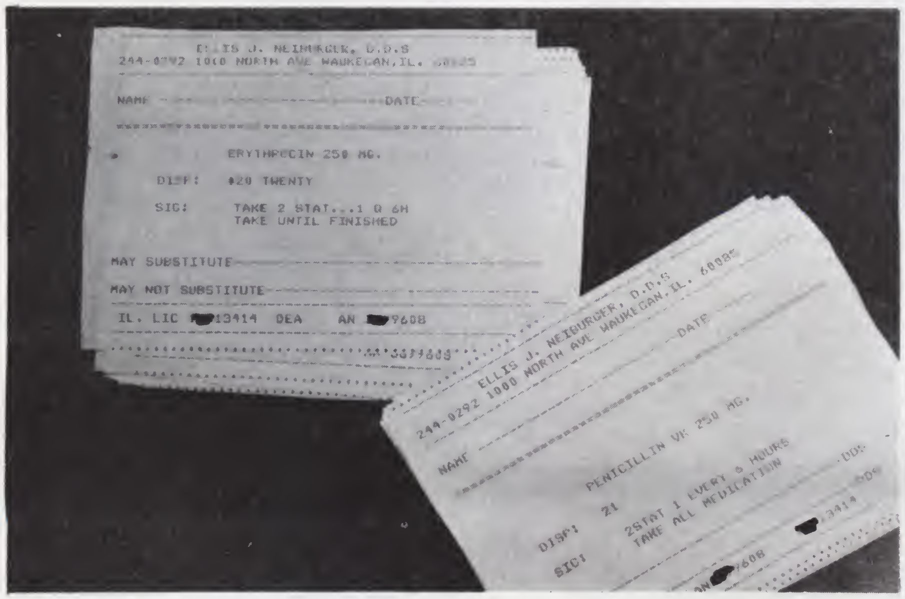
Doctors can learn when convenient, and do this without traveling or closing their offices. Errors in treatment need only influence computer simulations, not actual patients.

Summary

The dental/medical practice has unique problems that can be alleviated by computers. Appointments, insurance, billing, patient records, payroll and the like are becoming serious problems in manually run offices. Since 90 percent of most problems occur in select areas of the practice, a small computer system is ideal.

A microcomputer system allows the partial computerization of operations that the doctor cannot control by manual means. It gives the practitioner more control at less cost in time and money for the patient, the staff and the doctor.■

Questions concerning the availability of the programs mentioned in this article should be addressed to the author, along with an SASE.



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This personal finance simulation program, which you can easily convert to your own BASIC, puts you in control of your purse strings.

Focus In on Your Financial Picture

By Jim Shreeve

This simulation program lets you input financial information and predict what's going to happen in the future.

The program is simple, and can be customized to suit your personal or small-business needs. You put the essential facts on a cassette or disk, so they don't have to be reentered every time you run the program. You can adjust your data to fit different options in your present situation, thus giving you a basis for deciding just how much a change will make to your financial picture any number of years down the road.

The program includes the following features:

- It calculates mortgage payments.
- It calculates taxes and insurance for your home.
- It figures value of your home over the coming years.
- It gives a tax break on home payments for your tax bracket.
- It includes the cost-of-living increase over the years.
- It shows income increases each year.
- It weighs cost of living against income.
- It figures income taxes from gross pay.
- It shows take-home pay.
- It makes square footage estimates on new homes.
- It is expandable to cover other variables.

Keep in mind that a simulation program bases its projections on facts only. It cannot take into account a natural catastrophe or a raise in taxes. It is only as reliable as the facts you originally supply it.

This program runs under MSI Extended Disk BASIC. I have used traditional commands, so it should be easy to convert to your own BASIC. The only problem you may have is with a special subroutine to provide screen clearing and cursor placement for my terminal. I have a standard subroutine located at lines 9900 to the end of the program that builds character sets that output the proper control characters to my Heathkit H19 terminal. The H19 uses two-character escape sequences to control it. I merely build these into strings in the subroutine at 9900; then all that's left is to print the strings to the terminal to get the effect wanted.

The screen of your terminal will fill up with data each time you make a correction to the data on the screen. If your terminal is fast or has a small display area (like a 32×16), it is okay as is. If you have a large display like an 80×24 or if you run at a slow speed (below 1200 bits per second), you may want to use the alternate display routine that uses X,Y positioning on the screen to fill in the data.

Here is what happens: in the example of the 80×24 display you have 1920 characters to fill the screen. Since the screen is nearly full of data with the program the way it is, if you are running at 300 bits per second and estimate 1000 characters on the screen, it will take 1000 characters times 10 bits per character, or about 33 seconds, to fill the screen. Each time you change a variable, you have to wait 30 seconds for the screen to refresh before you can verify that you made the right change.

If you use the optional character display setup (and have a terminal to support it), you will have to wait the first time you fill the screen. But each time you make a change, you'll only have to wait an instant while the BASIC program executes a subroutine to place the new data in the right place on the screen. If your computer has cursor positioning built right into the BASIC program, you'll be able to simplify the alternate routine considerably.

Organization of Program

The program is organized into three areas. First is data gathering, which works with the incoming facts file and interacts with the keyboard. Second is data processing, where the facts gathered are used to arrive at such things as total taxes and expenses. Third is the screen display of the data originally entered.

Part of the data-out portion of the program updates the data from the files to contain the information entered by the operator during data gathering. This means that each running of the program will start with the values used in the last running of the program. This is what gives the program its ease of use with so many variables.

Data processing is done in subroutines so that the user can make alterations to suit the special conditions under which the calculations are made. If the tax tables change, it will be simpler to change the tax table subroutine. Also, the local tax table will have to be customized for the area in which you live. If you have to enter AUSTIN for the city in question, you will not have the right tax base for NEW ORLEANS. By using a subroutine, you are able to include any taxes exclusive to your area too. The subroutine eliminates messing with data and read statements.

You may use the tax table information on property taxes as given to get you started, but you'll want to get

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your own local tax tables entered into the program. It is not hard to collect the data: just call a local real estate office, tell them what you're doing and ask for the tax bases and insurance rates. They'll give you a rate per thousand dollars evaluation for local, county and state (if any). Some places will have special education taxes also. You plug those into the subroutine for taxes on property starting at line 9200.

There are some other facts plugged into the program that may be exclusive to your area. One of these is square footage calculations. The factors used in this program are about the national average but they may vary for homes in your area. Again, the local real estate agent can give you the three ranges for square footage of homes in your area. Program lines 8200–8230 contain the square footage subroutines. Note that a low-priced house sells for around $35 per square foot while a high-priced home sells for in the neighborhood of $45 per square foot. Supposedly, the extra $10 per square foot pays for higher-quality fixtures and better workmanship, along with a nicer lot in a so-called better neighborhood. You will learn a lot about real estate values in your area just by customizing this program.

Details of the Program

The program actually consists of two programs: a short one to set up the files with initial values to get the whole thing running and one I've already discussed. Listing 1 is the main program. Listing 2 is the file-building program. Listing 3 is that part of the program to be used when you don't want to wait for the screen to refresh between entries. Remember that Listing 3 requires a terminal capable of accepting cursor position information. Begin by referring to Listing 1.

Data gathering—The listing shown spends its first lines (100–490) setting up the BASIC interpreter for string and line length and describing the program. The REM statements can be left out when they will use up too much memory. Otherwise, remarks provide a built-in refresher for users who will put this program away and then need to remember how to use it in coming months.

From 500 to 550, you're simply getting the files from the disk (or cassette). These are the initial values that will be used to show up on the screen as the program is started. They are the values left over from the last pro-

Listing 1. Main Personal Finance program in MSI Extended Disk BASIC.

```
0100 REM ----------------------------------------------------------------
0110 REM This program is a real life financial condition simulator which
0120 REM can simulate your finances for a selected number of years. The
0130 REM program was written expressly to aid in making decisions per-
0140 REM taining to the purchase of a home. The program is simply adapt-
0150 REM able to the tax and insurance base in your area just by changing
0160 REM a few of the lines of code.
0170 REM
0180 REM The program needn't be changed in some cases because the tax
0190 REM structure for the communities used in this program may be sim-
0200 REM ilar to those in your area.
0210 REM
0220 REM Presently some of the codes are only stored (capital assets and
0230 REM similar things) you may leave these out, but the fact that they
0240 REM are stored on disc may in itself prove handy.
0250 REM Basically the program covers the following things:
0260 REM * Price of home under consideration
0270 REM * Size of downpayment
0280 REM * Inflation rate
0290 REM * Income
0300 REM * % Average pay raises
0310 REM * Costs of living
0320 REM * Square footage calculations
0330 REM * Appreciation rate of home in %
0340 REM
0350 REM The program inputs are easily changed. Its outputs provide the
0360 REM following information for the number of years specified:
0370 REM * Salary breakdown (take home pay)
0380 REM * House payment (including taxes and insurance)
0390 REM * Deduction of fixed expenses
0400 REM * Appreciated value of house
0410 REM * Tax break value of house
0420 REM
0430 REM ----------------------------------------------------------------
0470 DIGITS= 2
0480 STRING= 80
0490 LINE= 132
0500 OPEN #10 , "GARBAGE" FOR UPDATE
0510 OPEN #20 , "MORGARB" FOR UPDATE
0520 FIELD #10,A=9,B=4,C=4,D=6,F=1,G=2,H=4,J=6,K=5,L=4,M=1,N=9,P=10,W=9
0530 FIELD #20, X4=6,X5=6,X6=6,X7=9,A$=16,C1=4
0540 GET #10
0550 GET #20
0560 GOSUB 9900
0570 LET E=1
0580 PRINT X$(4);E;" SALARY $";A
0610  E=E+1 :PRINT E;" % PAY RAISES ";B
0620  E=E+1 :? E;" TAXED AS ";
0630 IF M=1 THEN PRINT "NOT ";
0640 PRINT "MARRIED"
0650  E=E+1 :PRINT E;" OTHER INCOME PER ANNUM ";W
0655 PRINT
0660  E=E+1 :PRINT E;" INFLATION RATE PER ANNUM ";C
0670  E=E+1 :PRINT E;" PRICE OF FOOD PER MONTH ";X4
0680  E=E+1 :PRINT E;" COST OF UTILITIES PER MO. ";X5
0690  E=E+1 :PRINT E;" CAR EXPENSES INCLUDING PAYMENT PER MO. ";X6
0700  E=E+1 :PRINT E;" ALL OTHER COSTS PER MONTH ";X7
0710 PRINT
0720  E=E+1 :PRINT E;" CASH ASSETS ";N;
0730  E=E+1 :PRINT TAB( 40 ); E;" HARD ASSETS ";P
0740  E=E+1 :PRINT E;" VALUE OF CAR ";K
0750 PRINT
0760  E=E+1 :PRINT E;" PRICE OF HOME ";D;
0770  E=E+1 :PRINT TAB( 40 );E;" DOWNPAYMENT ";J
0780  E=E+1 :PRINT E;" THE HOME IS ";:IF F=1 THEN PRINT "USED "
0790 IF F=2 THEN PRINT "NEW" :GOTO 800
0795 PRINT
0800  E=E+1 :PRINT E;" MORTGAGE INTEREST RATE ";L;
0810  E=E+1 :PRINT TAB( 40 );E;" SQ. FT. OR VAL RANGE 1,2,3 ";H
0815 PRINT
0820  E=E+1 :PRINT E;" NUMBER OF YEARS TO REPORT ";G
0822  E=E+1 :PRINT E;" APPRECIATION % ";C1
0825 LET B$="ENTER NUMBER OF SELECTION. ENTER -DONE- TO EXIT ROUTINE"
0830 GOSUB 9800 :? X$( 6 );TAB( 10 );
0840 PRINT TAB( 10 );B$;TAB( 45 );X$( 3 );X$( 7 );
0850 LET X=1:Y=24
0860 GOSUB 9900
0870 PRINT X$( 2 );"[ ]";
0880 INPUT B$
0885 IF B$="" THEN 850
0890 IF B$="DONE" THEN GOTO 1000
0900 LET E=VAL( B$ )
0910 IF E>11 THEN 940
0915 IF E<1 THEN 850
0920 ON E GOSUB 8010,8020,8030,8040,8050,8060,8070,8080,8090,8100,8110
0930 GOTO 560
0940 LET E=E-11
0945 IF E>8 THEN 850
0950 ON E GOSUB 8120,8130,8140,8150,8160,8170,8180,8300
0960 GOTO 560
1000 PRINT "IF TOWN IS ";A$;" HIT RETURN. ELSE ENTER TOWN";
1002 INPUT B$
1003 IF B$="" GOTO 1010
1005 LET A$=B$
1010 REWRITE #20
1015 REWRITE #10
1020 LET U=D
1030 PRINT X$( 9 );X$( 4 );
1050 LET S=0
1060 GOSUB 9200
```

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three
four
five
six
seven
eight
nine
ten
eleven
twelve
thirteen
fourteen
fifteen
sixteen
seventeen
eighteen
nineteen
twenty
thirty
forty
fifty
sixty
seventy
eighty
ninety
hundred
thousand
million
zero
again
ampere
and
at
cancel
case
cent
400hertz tone
80hertz tone
20ms silence
40ms silence
80ms silence
160ms silence
320ms silence
centi
check
comma
control
danger
degree
dollar
down
equal
error
feet
flow
fuel
gallon
go
gram
great
greater
have
high
higher
hour
in
inches
is
it
kilo
left
less
lesser
limit
low
lower
mark
meter
mile
milli
minus
minute
near
number
of
off
on
out
over
parenthesis
percent
please
plus
point
pound
pulses
rate
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ready
right
ss
second
set
space
speed
star
start
stop
than
the
time
try
up
volt
weight
a
b
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circuit
cigar
close
cold
complete
continue
copy
correct
crease
"de"
deposit
dial
door
east
"ed"
emergency
enter
entry
"er"
"eth"
evacuate
exit
fail
failure
fahrenheit
fast
faster
fifth
fire
first
floor
fourth
forward
from
gas
get
going
green
hale
heat
hello
help
hurts
hold
hot
in
incorrect
intruder
key
level
light
load
lock
longer
more
move
next
no
normal
north
not
notice
open
operator
or
pass
per
power
press
pressure
process
pull
push
put
quarter
range
reached
receive
record
reverse
red
repair
repeat
replace
room
safe
second
secure
select
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service
side
slow
slower
smoke
south
station
switch
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Listing 1 continued.

```
1070 IF S=0 THEN LET A$="AUSTIN" : GOTO 1050
1075 LET A=A+W
1080 ON M GOSUB 9000,9100
1090 LET R=A*.0613
1100 PRINT X$(4);TAB(35);"DETAILS FOR YEAR ";
1120 PRINT
1130 PRINT "INCOME ";A/12;"  FICA ";R/12;"  FED ICT ";Q/12;
1140 LET X1=A/12-(R+Q)/12 :PRINT "    TOT ";X1
1150 PRINT : PRINT
1160 PRINT "PAYMENT ";T1;"  TAXES & INS ";S;"    TOT ";
1170 LET X2=T1+S :PRINT X2
1175 PRINT
1180 PRINT "ADD IN FOOD ";X4;" AND UTIL ";X5;" AND AUTO ";X6;
1190 PRINT "OTHER ";X7;" TOT ";
1200 LET X8=X4+X5+X6+X7 :PRINT X8
1205 LET D=D+D*(C1/100)
1210 PRINT : PRINT TAB(50);"VAL OF HOUSE ";D
1220 LET X9=X1-(X2+X8)
1230 PRINT "GRAND TOTAL MONTHLY ";X9
1231 LET I=A : LET A=A-(X2*12)
1232 LET Z=Q : ON M GOSUB 9000,9100
1235 LET Q=Z-Q : PRINT "TAX BREAK ";Q : LET Q=Z
1237 LET A=I
1240 PRINT
1245 PRINT "ENTER [BAK] to go back and change parameters"
1250 PRINT "ENTER [NXT] for next years look at stuff"
1260 PRINT "ENTER [STP] to stop program"
1270 INPUT "WHICH ENTRY",B$
1280 IF B$="STP" THEN CLOSE #10:CLOSE#20: END
1290 IF B$="BAK" THEN CLOSE #10:CLOSE #20:GOTO 500
1300 REM DATA UPDATER
1305 LET X2=X2*12
1310 FOR E=1 TO G
1340 LET A=A+A*(B/100)
1350 ON M GOSUB 9000,9100
1360 LET R=.0613*A
1370 LET X1=A-(R+Q)
1390 PRINT "TOTAL INCOME NET ";X1
1400 PRINT "TOTAL ON HOUSE ";X2
1410 LET X8=X8+X8*(C/100)
1420 PRINT "TOTAL EXPENSES ";X8*12
1425 LET X9=X1-(X2+X8*12)
1430 PRINT "TOTAL                      ";X9
1435 GOSUB 1500
1440 NEXT E
1450 STOP
1460 GOTO 1245
1500 LET I=A
1510 LET A=A-X2
1515 LET Z=Q
1520 ON M GOSUB 9000,9100
1530 LET Z=Z-Q
1540 GOSUB 1600
1550 PRINT "TAX BREAK ";Z
1555 PRINT :PRINT
1560 LET A=I
1570 RETURN
1600 LET D=D+D*(C1/100)
1610 PRINT TAB(40);"VALUE OF HOME ";D
1620 RETURN
8000 REM REPAIR SUBROUTINES
8010 INPUT "SALARY ",A
8015 RETURN
8020 INPUT "% PAY RAISES ",B
8025 RETURN
8030 INPUT "1-IF SINGLE  2-MARRIED",M
8035 RETURN
8040 INPUT "OTHER INCOME",W
8045 RETURN
8050 INPUT "INFLATION RATE IN %",C
8055 RETURN
8060 INPUT "FOOD (MONTHLY) $",X4
8065 RETURN
8070 INPUT "UTILITIES (MONTHLY) $";X5
8075 RETURN
8080 INPUT "AUTOMOTIVE COSTS GAS,PAYMENT,ALL (MONTHLY) $",X6
8085 RETURN
8090 INPUT "OTHER MONTHLY LIVING COSTS $",X7
8095 RETURN
8100 INPUT "CASH ASSETS",N
8105 RETURN
8110 INPUT "HARD ASSETS (DEPRECIABLE)",P
8115 RETURN
8120 INPUT "VALUE OF CAR",K
8125 RETURN
8130 INPUT "PRICE OF HOME",D
8135 RETURN
8140 INPUT "DOWNPAYMENT",J
8145 RETURN
8150 INPUT "1-FOR USED  2-FOR NEW",F
8155 RETURN
8160 INPUT "INTEREST RATE %",L
8165 RETURN
8170 INPUT "SQ FT ENTER 0 IF UNKNOWN",H
8172 IF H=0 THEN 8200
8175 RETURN
8180 INPUT "NUMBER OF YEARS FOR REPORT",G
8185 RETURN
8200 INPUT "VALUE RANGE OF HOUSE 1-LOW 2-MED 3-HI",I
8210 IF I=1 THEN H=INT(D/35)
8220 IF I=2 THEN H=INT(D/40)
8230 IF I=3 THEN H=INT(D/45)
```

More

Listing 1 continued.

```
8240 RETURN
8300 INPUT "HOUSE APPRECIATION % ",C1
8310 RETURN
9000 REM SINGLE TAX RATES
9002 LET Q=0
9005 IF A>108300 THEN Q=55697+.7*(A-108300)
9007 IF Q>0 THEN RETURN
9010 IF A>81800 THEN Q=37677+.68*(A-81800)
9011 IF Q>0 THEN RETURN
9015 IF A>55300 THEN Q=20982+.63*(A-55300)
9016 IF Q>0 THEN RETURN
9020 IF A>41500 THEN Q=13392+.55*(A-41500)
9021 IF Q>0 THEN RETURN
9025 IF A>34100 THEN Q=9766+.49*(A-34100)
9026 IF Q>0 THEN RETURN
9030 IF A>28800 THEN Q=7434+.44*(A-28800)
9031 IF Q>0 THEN RETURN
9035 IF A>23500 THEN Q=5367+.39*(A-23500)
9036 IF Q>0 THEN RETURN
9040 IF A>18200 THEN Q=3565+.34*(A-18200)
9041 IF Q>0 THEN RETURN
9045 IF A>15000 THEN Q=2605+.30*(A-15000)
9046 IF Q>0 THEN RETURN
9050 IF A>10800 THEN Q=1555+.24*(A-10800)
9051 IF Q>0 THEN RETURN
9055 IF A>8500  THEN Q=1072+.21*(A-8500)
9056 IF Q>0 THEN RETURN
9060 IF A>6500  THEN Q=692+.19*(A-6500)
9061 IF Q>0 THEN RETURN
9065 IF A>4400  THEN Q=314+.18*(A-4400)
9066 IF Q>0 THEN RETURN
9070 IF A>3400  THEN Q=154+.16*(A-3400)
9071 IF Q>0 THEN RETURN
9075 IF A>2300  THAN Q=.14*(A-2300)
9080 IF A<2300  THEN Q=0
9085 RETURN
9100 REM THIS IS TAX TABLE FOR MARRIED (JOINT)
9101 LET Q=0
9105 IF A>215400 THEN Q=11750+.7*(A-215400)
9106 IF Q>0 THEN RETURN
9110 IF A>162400 THEN Q=81464+.68*(A-162400)
9111 IF Q>0 THEN RETURN
9115 IF A>109400 THEN Q=47544+.64*(A-109400)
9116 IF Q>0 THEN RETURN
9120 IF A>85600  THEN Q=33502+.59*(A-85600)
9121 IF Q>0 THEN RETURN
9125 IF A>60000 THEN Q=19678+.54*(A-60000)
9126 IF Q>0 THEN RETURN
9130 IF A>45800 THEN Q=12720+.49*(A-45800)
9131 IF Q>0 THEN RETURN
9135 IF A>35200 THEN Q=8162+.43*(A-35200)
9136 IF Q>0 THEN RETURN
9140 IF A>29900 THEN Q=6201+.37*(A-29900)
9141 IF Q>0 THEN RETURN
9145 IF A>24600 THEN Q=4505+.32*(A-24600)
9146 IF Q>0 THEN RETURN
9150 IF A>20200 THEN Q=3273+.28*(A-20200)
9151 IF Q>0 THEN RETURN
9155 IF A>16000 THEN Q=2265+.24*(A-16000)
9156 IF Q>0 THEN RETURN
9160 IF A>11900 THEN Q=1404+.21*(A-11900)
9161 IF Q>0 THEN RETURN
9165 IF A>7600  THEN Q=630+.18*(A-7600)
9166 IF Q>0 THEN RETURN
9170 IF A>5500  THEN Q=294+.16*(A-5500)
9171 IF Q>0 THEN RETURN
9175 IF A>3400  THEN Q=.14*(A-3400)
9180 IF A<3400  THEN Q=0
9185 RETURN
9200 REM
9201 IF A$="AUSTIN" THEN S=D*.00094+D*.0006+D*.0003+D*.00034
9205 IF A$="GEORGETOWN" THEN S=D*.00136+D*.00045+D*.0003+D*.00034
9210 IF A$="PFLUGERVILLE" THEN S=D*.00065+D*.00033+D*.0003+D*.00038
9215 IF A$="ROLLINGWOOD" THEN S=D*.00044+D*.0003+D*.00036
9220 IF A$="ROUND ROCK" THEN S=D*.00096+D*.0005+D*.00036+D*.00036
9225 IF A$="WESTLAKE HILLS" THEN S=D*.0016+D*.00021+D*.0003+D*.00011
9230 IF A$="ELGIN" THEN S=D*.0013+D*.00038+D*.00038+D*.00021
9235 IF A$="MANOR" THEN S=D*.00083+D*.00083+D*.00021+D*.00038
9240 IF A$="LEANDER" THEN S=D*.00109+D*.0005+D*.0003+D*.00036
9245 REM CALC P&I MO. PAYMENT WHILE YER HERE
9250  T1=(((1+L/1200)↑360)-1)/((L/1200)*((1+L/1200)↑360))
9252 LET Z1=D :LET D=D-J
9255  T1=D/T1
9260 LET D=Z1
9266 RETURN
9790 STOP
9800 REM ************* ENABLE TO WRITE ON 25 LINE *******************
9805 REM
9810 PRINT X$(1)
9815 PRINT X$(8)
9820 PRINT CHR$(27);CHR$(89);CHR$(56);CHR$(32);
9825 RETURN
9850 REM *********** DISABLE THE 25TH LINE *************************
9855 PRINT X$(9)
9860 RETURN
9890 STOP
9900 REM **********************************************************
9910 REM TERMINAL I/O PACKAGE
9920 REM
9930  X$(1)=CHR$(27)+CHR$(106)                :REM SAVE CURS POSITION
9940  X$(2)=CHR$(27)+CHR$(89)+CHR$(31+Y)+CHR$(31+X):REM SET TO X,Y
9950  X$(3)=CHR$(27)+CHR$(107)                :REM SET TO PREV SAVED
```

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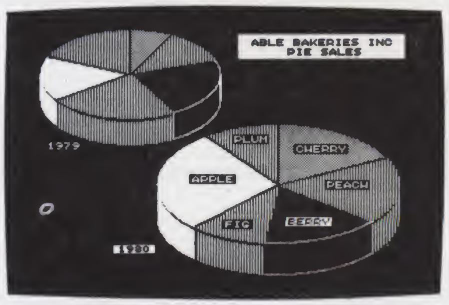

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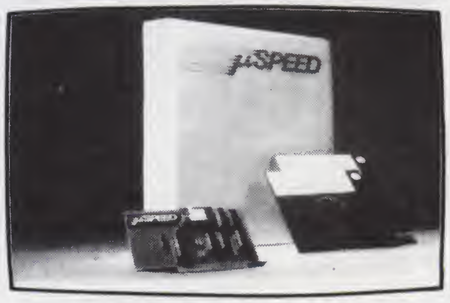

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gram run.

At line 560, there is a jump to the terminal initialization routine at 9900; you can leave it out. At 570 the counter variable E is set to 1. It will be advanced so that it will be referenced when it comes time to change the value of that parameter. Note that in line 580, the string X$(4) clears the terminal. If you have some other way to do this on your terminal you'll have to use it.

From here through much of the program, you merely display the counter E and then type out a description such as INFLATION RATE PER ANNUM, followed by the variable representing that value. The variable C is the inflation rate. Line 825 stops the printing of the variables and values and allows entry of a number. Things look irregular here, but they deal with printing on the 25th line of the terminal. Discard if you have no 25th line.

Lines 880–960 cause a jump to the relevant subroutine up at 8000 to allow changing of a particular parameter. Typing in DONE jumps the user to 1000 where the town (for tax reasons) is entered. Lines 1010 and 1015

Listing 1 continued.

```
9960   X$( 4 )=CHR$( 27 )+CHR$( 69 )                 :REM H/U- ERASE
9970   X$( 5 )=CHR$( 27 )+CHR$( 75 )                 :REM ERASE LINE FM CURSOR
9980   X$( 6 )=CHR$( 27 )+CHR$( 112 )                :REM REV VIDEO ON
9990   X$( 7 )=CHR$( 27 )+CHR$( 113 )                :REM REV VIDEO OFF
9991   X$( 8 )=CHR$( 27 )+CHR$( 120 )+CHR$( 49 )  :REM ENABLE 25TH LINE
9992   X$( 9 )=CHR$( 27 )+CHR$( 121 )+CHR$( 49 )  :REM DISABLE 25TH LINE
9993   X$( 10 )=X$( 10 )                             :REM FOR TEMP STORAGE
9994  RETURN
```

Listing 2. File-building program.

```
0100 REM THIS IS TO CREATE THE ORIGINAL DISKETTE FILES FOR THE SIMULATION
0500 OPEN #10, "GARBAGE" FOR OUTPUT
0510 FIELD #10,A=9,B=4,C=4,D=6,F=1,G=2,H=4,J=6,K=5,L=4,M=1,N=9,P=10,W=9
0520 LET A=20000.00
0530 LET B=8
0540 LET C=10
0550 LET D=60000
0560 PUT #10
0570 CLOSE #10
0580 OPEN #10, "MORGARB" FOR OUTPUT
0590 FIELD #10, X4=6,X5=6,X6=6,X7=9,A$=16,C1=4
0600 PUT #10
0610 CLOSE #10
0620 END
```

Listing 3.

```
0100 REM **************************************************
0110 REM THIS PROGRAM IS REALLY A SET OF BASIC PATCHES
```

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cause the data that has been entered to be stored on the disk. Next, the calculations on that data begin.

Data processing—Starting with the portion of the program in line 1020 and continuing from there to the third part of the program, the first mathematics take place. Line 1060 sends the relevant variables through a subroutine (at lines 90 to 9266) which calculates the local taxes and insurance rates for the particular area of interest. To set up your own area, you must set up each line of the subroutine for each tax entity in your area. The factors that are multiplied by the price of the house (variable D) are the ones you get from your friendly real estate agent.

Towards the end of the subroutine (line 9250 and on), you roll the variable D through some math that calculates a payment based on 30 years, 360 payments. You can add the flexibility of using other mortgage payment plans by adding some variables and prompts earlier in the program. Don't forget to add any new variables to the disk or cassette file, so that they will appear automatically in your calculations.

Listing 3 continued.

```
0120 REM THE PATCHES ALLOW YOU TO PUT THE VARIABLES ON
0130 REM THE SCREEN OF THE TERMINAL RIGHT BESIDE THE
0140 REM PROMPT. THIS ELIMINATES REFRESHING THE WHOLE
0150 REM SCREEN EACH TIME A CHANGE IS MADE. YOUR TERM-
0160 REM INAL MUST SUPPORT DIRECT CURSOR ADDRESSING.
0170 REM ***************************************************
0180 REM
0190 REM
0460 DEF FNE(X)=X+1
0470 DIGITS= 0
0480 STRING= 80
0490 LINE= 132
0500 OPEN #10 , "GARBAGE" FOR UPDATE
0510 OPEN #20 , "MORGARB" FOR UPDATE
0520 FIELD #10,A=9,B=4,C=4,D=6,F=1,G=2,H=4,J=6,K=5,L=4,M=1,N=9,P=10,W=9
0530 FIELD #20,X4=6,X5=6,X6=6,X7=9,A$=16,C1=4
0540 GET #10
0550 GET #20
0560 GOSUB 9900
0570 PRINT X$(4);
0580 GOSUB 7010
0590 GOSUB 7020
0600 GOSUB 7030
0610 GOSUB 7040
0620 GOSUB 7050
0630 GOSUB 7060
0640 GOSUB 7070
0650 GOSUB 7080
0660 GOSUB 7090
0670 GOSUB 7100
0680 GOSUB 7110
0690 GOSUB 7120
0700 GOSUB 7130
0710 GOSUB 7140
0720 GOSUB 7150
0730 GOSUB 7160
0740 GOSUB 7170
0750 GOSUB 7180
0755 GOSUB 7200
0760  X=21:Y=1:GOSUB 9900:PRINT X$(2);
0770 PRINT CHR$(27);"J";
0775 INPUT "[ ]",B$
0780 IF B$="DONE" THEN 1000
0790 IF B$="" THEN 770
0800 LET Z=VAL(B$)
```

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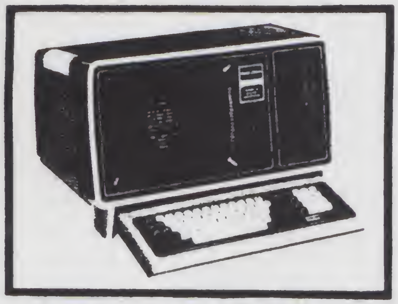

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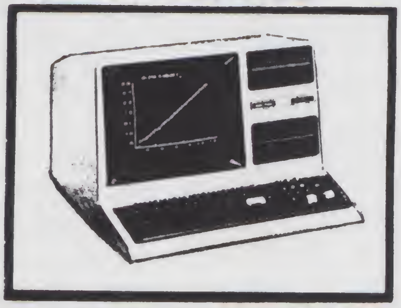

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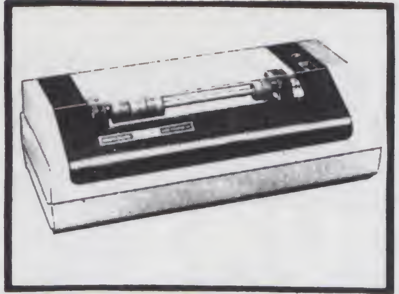

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Listing 3 continued.

```
0810 IF Z>10 GOTO 830
0820 ON Z GOSUB 8010,8030,8020,8040,8050,8060,8070,8080,8090,8100
0825 GOTO 850
0830 LET Z=Z-10
0840 ON Z GOSUB 8110,8120,8130,8140,8150,8160,8170,8180,8260
0850 IF Z>18 THEN 770
0860 GOTO 760
1000 PRINT "IF TOWN IS ";A$;" HIT RETURN. ELSE ENTER TOWN";
1002 INPUT B$
1003 IF B$="" GOTO 1010
1005 LET A$=B$
1010 REWRITE #20
1015 REM
1020 REM ***********************************************
1030 REM IN THIS PART OF THE PROGRAM, IT IS JUST LIKE
1040 REM THE ORIGINAL. YOU DO THE MATH AND SOME OTHER
1050 REM THINGS.
1060 REM ***********************************************
1070 REM
7000 REM This is where we put in the values
7010  X=1:Y=1:GOSUB 9900:PRINT X$(2);
7012 PRINT "1  SALARY   =$";A;
7015 RETURN
7020  X=1:Y=45:GOSUB 9900:PRINT X$(2);
7022 PRINT "2  TAX AS ";
7024 IF M=1 THEN PRINT "SINGLE "
7026 IF M=2 THEN PRINT "MARRIED"
7028 RETURN
7030  X=2:Y=1: GOSUB 9900:PRINT X$(2);
7032 PRINT "3  RAISES % =";B;
7035 RETURN
7040  X=2:Y=45:GOSUB 9900:PRINT X$(2);
7042 PRINT "4  OTHER INCOME =$";W
7045 RETURN
7050  X=4:Y=1:GOSUB 9900:PRINT X$(2);
7052 PRINT "5  INFLATION=%";C;
7055 RETURN
7060  X=4:Y=45:GOSUB 9900:PRINT X$(2);
7062 PRINT "6 FOOD/MONTH =$";X4
7065 RETURN
7070  X=5:Y=1:GOSUB 9900:PRINT X$(2);
7072 PRINT "7  UTILS/MO =$";X5;
7075 RETURN
7080  X=5:Y=45:GOSUB 9900:PRINT X$(2);
7082 PRINT "8 AUTO EXP/MO=$";X6
7085 RETURN
7090  X=6:Y=1:GOSUB 9900:PRINT X$(2);
7092 PRINT "9  MISC/MO  =$";X7
7095 RETURN
7100  X=8:Y=1:GOSUB 9900:PRINT X$(2);
7102 PRINT "10 ASSETS/CASH $";N;
7105 RETURN
7110  X=8:Y=45:GOSUB 9900:PRINT X$(2);
7112 PRINT "11 ASSETS/DEP=$";P
7115 RETURN
7120  X=9:Y=1:GOSUB 9900:PRINT X$(2);
7122 PRINT "12 VALUE CAR=$";K
7125 RETURN
7130  X=11:Y=1:GOSUB 9900:PRINT X$(2);
7132 PRINT "13 PRICE/HM =$";D;
7135 RETURN
7140  X=11:Y=45:GOSUB 9900:PRINT X$(2);
7142 PRINT "14 DOWNPAYMENT=$";J
7145 RETURN
7150  X=12:Y=1:GOSUB 9900:PRINT X$(2);
7152 PRINT "15 THE HOME IS ";
7154 IF F=1 THEN PRINT "USED";
7155 IF F=2 THEN PRINT "NEW "
7157 RETURN
7160  X=12:Y=45:GOSUB 9900:PRINT X$(2);
7162 PRINT "16 MORT INT % =";L
7165 RETURN
7170  X=13:Y=1:GOSUB 9900:PRINT X$(2);
7172 PRINT "17 SQUARE FT =";H
7175 RETURN
7180  X=15:Y=1:GOSUB 9900:PRINT X$(2);
7192 PRINT "18 YRS REPORT ";G
7195 RETURN
7200  X=16:Y=1:GOSUB 9900:PRINT X$(2);
7202 PRINT "19 APRECIATION IN % ";C1
7205 RETURN
8000 REM REPAIR SUBROUTINES
8010 INPUT "SALARY ",A
8012 GOSUB 7010
8015 RETURN
8020 INPUT "% PAY RAISES ",B
8022 GOSUB 7030
8025 RETURN
8030 INPUT "1-IF SINGLE  2-MARRIED",M
8032 GOSUB 7020
8035 RETURN
8040 INPUT "OTHER INCOME",W
8042 GOSUB 7040
8045 RETURN
8050 INPUT "INFLATION RATE IN %",C
8052 GOSUB 7050
8055 RETURN
8060 INPUT "FOOD (MONTHLY) $",X4
8062 GOSUB 7060
8065 RETURN
8070 INPUT "UTILITIES (MONTHLY) $",X5
8072 GOSUB 7070
```

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Listing 3 continued.

```
8075 RETURN
8080 INPUT "AUTOMOTIVE COSTS GAS,PAYMENT,ALL (MONTHLY) $",X6
8082 GOSUB 7080
8085 RETURN
8090 INPUT "OTHER MONTHLY LIVING COSTS $",X7
8092 GOSUB 7090
8095 RETURN
8100 INPUT "CASH ASSETS",N
8102 GOSUB 7100
8105 RETURN
8110 INPUT "HARD ASSETS (DEPRECIABLE)",P
8112 GOSUB 7110
8115 RETURN
8120 INPUT "VALUE OF CAR",K
8122 GOSUB 7120
8125 RETURN
8130 INPUT "PRICE OF HOME",D
8132 GOSUB 7130
8135 RETURN
8140 INPUT "DOWNPAYMENT",J
8142 GOSUB 7140
8145 RETURN
8150 INPUT "1-FOR USED  2-FOR NEW",F
8152 GOSUB 7150
8155 RETURN
8160 INPUT "INTEREST RATE %",L
8162 GOSUB 7160
8165 RETURN
8170 INPUT "SQ FT ENTER 0 IF UNKNOWN",H
8172 IF H=0 THEN 8200
8174 GOSUB 7170
8175 RETURN
8180 INPUT "NUMBER OF YEARS FOR REPORT",G
8182 GOSUB 7180
8185 RETURN
8200 INPUT "VALUE RANGE OF HOUSE 1-LOW 2-MED 3-HI",I
8210 IF I=1 THEN H=INT(D/35)
8220 IF I=2 THEN H=INT(D/40)
8230 IF I=3 THEN H=INT(D/45)
8235 GOSUB 7170
8240 RETURN
8260 INPUT "APRECIATION IN % ",C1
8262 GOSUB 7200
8265 RETURN
8990 REM
9000 REM *****************************************************
9010 REM FROM HERE ON TO THE END, THE PROGRAM IS THE
9020 REM SAME AS THE ORIGINAL. ALL THE TAX TABLES ARE
9030 REM HERE. IN THE CASE OF HEATHKIT H19 TERMINAL
9040 REM USERS, YOU MUST INCLUDE THE TERMINAL SUBROUTINES.
9050 REM *******************************************************
9060 REM
```

```
 1.00  SALARY $38500.00
 2.00  % PAY RAISES 8.00
 3.00  TAXED AS MARRIED
 4.00  OTHER INCOME PER ANNUM 0.00

 5.00  INFLATION RATE PER ANNUM 12.00
 6.00  PRICE OF FOOD PER MONTH 175.00
 7.00  COST OF UTILITIES PER MO. 100.00
 8.00  CAR EXPENSES INCLUDING PAYMENT PER MO. 300.00
 9.00  ALL OTHER COSTS PER MONTH 300.00

 10.00  CASH ASSETS 2000.00             11.00  HARD ASSETS 2500.00
 12.00  VALUE OF CAR 6600.00

 13.00  PRICE OF HOME 68000.00          14.00  DOWNPAYMENT 3400.00
 15.00  THE HOME IS NEW
 16.00  MORTGAGE INTEREST RATE 11.50    17.00  SQ. FT. OR VAL RANGE 1,2,3 151
.00

 18.00  NUMBER OF YEARS TO REPORT 5.00
 19.00  APPRECIATION % 10.00
```

Listing 4.

Back at the program, line 1080 sends you to the married or unmarried tax tables at lines 9000 or 9100. Looking at the tables at 9000, the single tables, you will see that this is the back page of the instruction booklet for calculating your own taxes for the IRS form 1040. You set Q=0, and if the table gives it a value, you exit the tables and return from the subroutine. Say your earn $20,000. If you compare the income variable A with $108,300, you see that the routine scoots you along to the next line. In line 9040 the variable A finally meets the compare criteria. Mainly, A is greater than $18,200 so the tax is calculated to be $3565 plus 34 percent of the remaining amount over $18,200. Now Q has a value greater than 0 so line 9041 ends the subroutine.

Note that the preceding tax calculations are done with no dependents. If you have dependents, you need to subtract the standard deduction for each before you enter the single or married tax tables.

With the tax calculated, you need only to figure the Social Security withholding. This is done back at line 1090.

Data out—Starting at line 1100, the printout section of the program begins. Calculations must still be done, but they will be done as the data is printed. The data collected so far and some other data is used to create the first-year display. At the end of the first-year display, after you've had a chance to observe the end totals, you can display the coming years as you have chosen, or you can go back and adjust your figures. If you get too discouraged after the first year, you can just quit.

All these choices come in lines 1240–1290. Beginning at line 1300, you do the recalculations and displays for the series of years you requested in the early part of the program. Note that you adjust the income variable A for pay raises, then recalculate the taxes. You also calculate expenses each year, taking into account the effect of inflation. Look at lines 1500 through 1570. Here you are holding some of the values that are changing and then sending things back through the tax tables to calculate tax benefits of home ownership, taxes with new income and so on.

Summary

Listing 4 is a sample run. You can see how each of the variables is affecting the outputs. In cases where you will be adding new variables for consideration, keep in mind the three basic sections of the program and be sure to add your new variable in each appropriate section.

Especially keep in mind the subroutines starting at 8000 labeled as the repair subroutines. They're really a part of the input portion of the program. If you forget to put your new variable in subroutine 8000, you won't be able to change its value in succeeding calculations, and you'll get wrong answers.

And finally, a reminder not to forget to add your new variables to the disk or cassette files so that you will not have to reenter the value each time you run the program.■

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The 58 bytes of the Multiple Interval Timer program solve those problems. No registers or flags are changed when these delay routines are called. In some cases the B register is used to pass a parameter. Listing 1 shows the routines as they would appear if you assembled the code under CP/M to run on a 4 MHz Z-80 microprocessor. Listings 2 and 3 show modifications for other systems.

The listings are shown as if assembled at 0100 (hexadecimal), but you'll probably want to put them in read-only memory, where they'll always be available. If you sometimes change the speed at which your system operates, the one byte labeled DELCONST should be in programmable memory.

If you include a CALL SMSEC instruction in one of your programs, your processor will be tied up for exactly 250 T-states or clock cycles (e.g., there are 4 million T-states (cycles) per second in a clock running at 4 MHz): 17 for the CALL, 69 for the instructions in SMSEC except for the

Listing 1. These subroutines can be assembled by CP/M for execution on a 4 MHz Z-80. They provide convenient general-purpose delays ranging from 62.5 µs to 255 seconds. The millisecond and fractional millisecond delays claimed are exact if your clock rate is exactly 4 MHz and there are no wait states.

```
                  ; Multiple interval timer for 4 MHz Z-80
                  ; Lee Bonnifield
                  ; 1025 Chalk Level Rd - Durham NC 27704

0100                                ORG     0100H

                  ; This sets the number of times the
                  ; innermost loop at L3 will be executed
000D =            LOOPS             EQU     13

                  ; Define the Z-80 instruction to CP/M
0010 =            DJNZ              EQU     10H

                  ; Delay number of seconds in B register
0100 C5F5         BSEC:             PUSH B ! PUSH PSW
0102 CD0A01       L1:               CALL    SEC
0105 10FB                           DB      DJNZ,L1-$-1 AND 00FFH
0107 F1C1                           POP PSW ! POP B
0109 C9                             RET

                  ; Delay 1 second
010A CD0D01       SEC:              CALL    HSEC

                  ; Delay 1/2 second
010D CD1001       HSEC:             CALL    QSEC

                  ; Delay 1/4 second
0110 C5           QSEC:             PUSH    B
0111 06FA                           MVI     B,250
0113 CD1801                         CALL    BMSEC
0116 C1                             POP     B
0117 C9                             RET

                  ; Delay number of milliseconds in B register
0118 C5F5         BMSEC:            PUSH B ! PUSH PSW
011A CD2201       L2:               CALL    MSEC
011D 10FB                           DB      DJNZ,L2-$-1 AND 00FFH
011F F1C1                           POP PSW ! POP B
0121 C9                             RET

                   ;Delay 1 millisecond
0122 CD2501       MSEC:             CALL    HMSEC

                  ; Delay 1/2 millisecond (500 µsec)
0125 CD2801       HMSEC:            CALL    QMSEC

                  ; Delay 1/4 millisecond (250 µsec)
0128 CD2B01       QMSEC:            CALL    EMSEC

                  ; Delay 1/8 millisecond (125 µsec)
012B CD2E01       EMSEC:            CALL    SMSEC
```

More →

Address correspondence to Lee Bonnifield, 1025 Chalk Level Road, Durham, NC 27704.

DJNZ, eight for the last execution of the DJNZ and 156 for the first 12 executions of the DJNZ. If your clock rate is exactly 4 MHz (and there are no wait states), exactly 62.5 µs will be consumed before your processor starts on the instruction following the CALL SMSEC. This minimum delay is one-Sixteenth of a MilliSECond; hence the acronym SMSEC.

It's simple to keep exactly doubling the delays with the earlier entry points for 1/8 ms, 1/4 ms, 1/2 ms and 1 ms. If you want a delay in the range of 2 to 255 ms, store the appropriate hexadecimal value (02 to 0FF) in the B register and CALL BMSEC.

If you have a 2 MHz Z-80, it's best to abandon the SMSEC entry point. Listing 2 shows the modification. This is a particularly useful version if you sometimes run at 4 MHz, because by changing the value at DELCONST to 32, the routines will work at 4 MHz almost as precisely. A CALL MSEC will consume .994 ms, close enough for all my needs.

Users with 8080s will have to change all the DJNZ instructions to DCR B ! JNZ instructions, taking a few more bytes and T-states. Listing 3 shows a way to achieve exact accuracy on a 2 MHz 8080.

The routines can be used with odd clock rates or wait states if you experiment with the value at DELCONST.

Listing 1 continued.

```
                ; Delay 1/16 millisecond (62.5 µsec)
012E C5         SMSEC:  PUSH    B                 ; 11 T-states
012F F5                 PUSH    PSW               ; 11
0130 3A3901             LDA     DELCONST          ; 13
0133 47                 MOV     B,A               ;  4
0134 10         L3:     DB      DJNZ              ;      13 for B>1
                                                  ;       8 for B=1
                                                  ; ______________
0135 FE                 DB      L3-$-1 AND 00FFH; 13(LOOPS-1) + 8
0136 F1                 POP     PSW               ; 10
0137 C1                 POP     B                 ; 10
0138 C9                 RET                       ; 10

                ; Total T-states for CALL SMSEC:
                ; 17 + 69 + 13(LOOPS-1) + 8 = 250
                ; At 4 MHz, 250 T-states = 62.5 µsec

0139 0D         DELCONST:       DB      LOOPS

013A                    END     0100H
```

```
                ; Multiple interval timer for 2 & 4 MHz Z-80
                ; All omitted lines are not
                ; changed from listing 1
                ; ...
                ; ...
                ; ...
0128 CD2B01     QMSEC:          CALL    EMSEC

                ; Delay 1/8 millisecond (125 µsec)
012B C5         EMSEC:  PUSH    B                 ; 11 T-states
012C F5                 PUSH    PSW               ; 11
012D 3A3601             LDA     DELCONST          ; 13
0130 47                 MOV     B,A               ;  4
0131 10         L3:     DB      DJNZ              ;      13 for B>1
                                                  ;       8 for B=1
                                                  ; ______________
0132 FE                 DB      L3-$-1 AND 00FFH; 13(LOOPS-1) + 8
0133 F1                 POP     PSW               ; 10
0134 C1                 POP     B                 ; 10
0135 C9                 RET                       ; 10
                ; Total T-states for CALL EMSEC:
                ; 17 + 69 + 13(LOOPS-1) + 8 = 250 if LOOPS=13
                ;                           = 497 if LOOPS=32
                ; At 2 MHz, 250 T-states = 125 µsec
                ; At 4 MHz, 497 T-states = 124.25 µsec

0136 0D         DELCONST:       DB      LOOPS
                ; For 4 MHz operation, change the
                ; value at DELCONST from 13 to 32

0137                    END     0100H
```

Listing 2. This modification to Listing 1 provides exact delays at the millisecond and fractional millisecond entry points for a 2 MHz Z-80. Changing the value of DELCONST allows for almost exact operation at 4 MHz.

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Greater precision can be obtained by eliminating the entry points for the shortest delays, as SMSEC was eliminated from Listing 2 and 3. This allows DELCONST to be larger, so that adjustments to it are finer. You'll probably never need accuracy closer than a few percent.■

```
                        ; Multiple interval timer for 8080
                        ; All omitted lines are not
                        ; changed from listing 1
                        ; ...
000D =                  LOOPS           EQU      10
                        ; ...
                        ; no need to define DJNZ
                        ; ...
                        ; ...
                        ; ...
0102 CD0C01             L1:             CALL     SEC
0105 05                                 DCR      B
0106 C20201                             JNZ      L1
                        ; ...
                        ; ...
                        ; ...
011C CD2601             L2:             CALL     MSEC
011F 05                                 DCR      B
0120 C21C01                             JNZ      L2
                        ; ...
                        ; ...
                        ; ...
                        ; Delay 1/4 millisecond (250 µsec)
012C CD2F01             QMSEC:          CALL     EMSEC

                        ; Delay 1/8 millisecond (125 µsec)
012F C5                 EMSEC:  PUSH    B                       ; 11 T-states
0130 F5                         PUSH    PSW                     ; 11
0131 3A3F01                     LDA     DELCONST                ; 13
0134 3A3F01                     LDA     DELCONST                ; 13
0137 47                         MOV     B,A                     ;  5
0138 05                 L3:     DCR     B                       ;      5
0139 C23801                     JNZ     L3                      ;     10
                                                                ; ----------
                                                                ; 15 * LOOPS
013C F1                         POP     PSW                     ; 10
013D C1                         POP     B                       ; 10
013E C9                         RET                             ; 10
                        ; Total T-states for CALL EMSEC:
                        ; 17 + 83 + 15*LOOPS = 250
                        ; At 2 MHz, 250 T-states =125 µsec

013F 0A                 DELCONST:       DB       LOOPS

0140                            END     0100H
```

Listing 3. This modification to Listing 1 provides exact delays at the millisecond and fractional millisecond entry points for a 2 MHz 8080. Notice that an 8080 requires more T-states (clock cycles) for some instructions than a Z-80.

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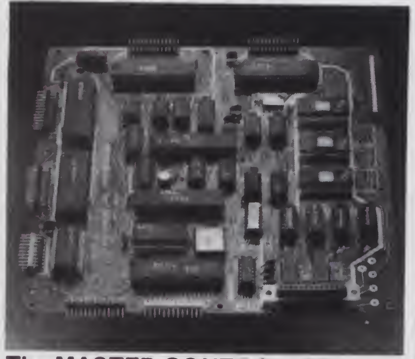

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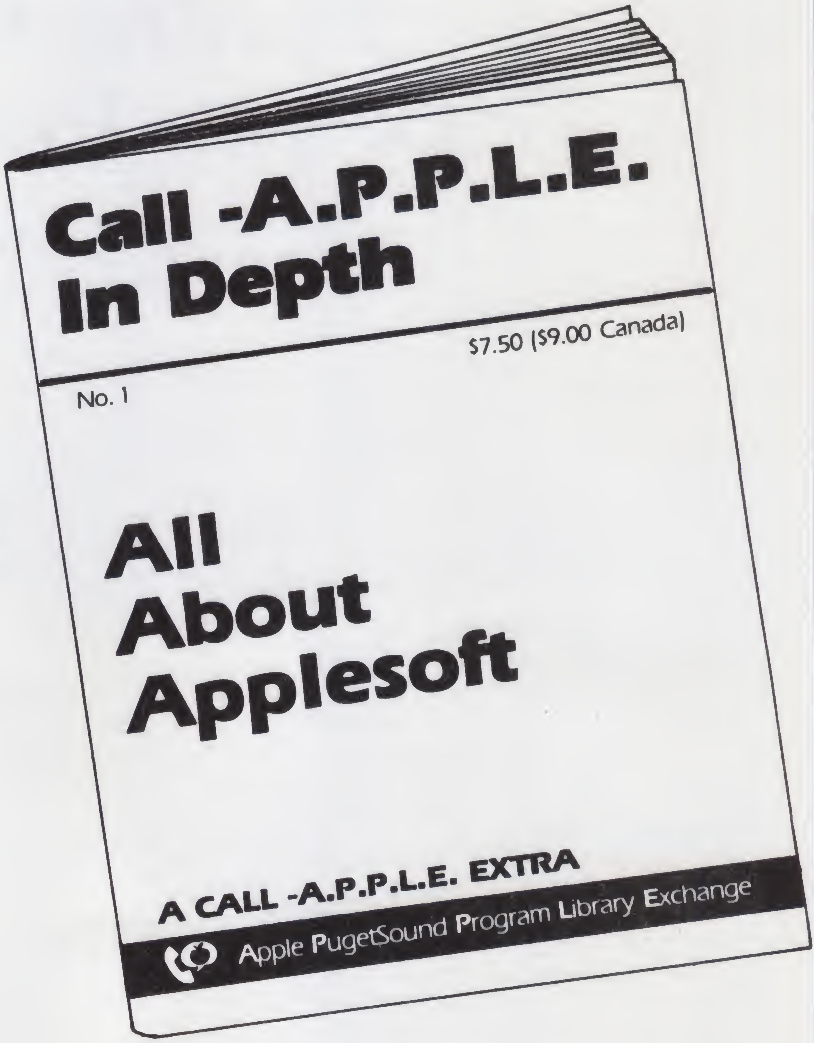

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If you can write on the PET with a few switches, why not program the PET with them? Here's how.

Putting the Joy Back into Programming

By Frank Donato

Last November, Alfred J. Bruey described in this magazine a way to write on the screen of the PET with switches attached to the application connector ("Microcomputer Hardware for the Handicapped," p. 173). Why not take his idea one step further, and use these switches to program?

This program does just that. It makes the PET execute a special insert program just before its normal interrupt routine, every 1/60 of a second, by changing the address of the interrupt routine (from E685 on the old PET or 2EE6 on the new PET) to the routine at 033A and then jumping back to the regular PET interrupt at the above address. (See Fig. 1.)

The program, then, runs invisible to the user.

By using a special joystick with three switches, the programmer can:

1. Control displaying or not displaying (normal PET operation) a subset of ASCII characters on the top right-hand corner of the PET screen.
2. Take the character displayed and place it at the current cursor position on the line and in the keyboard buffer.
3. Force a carriage return.

I use three microswitches attached to the PET user port lines, PA5, PA6 and PA7. The hardware details will be discussed later in this article.

Briefly, to effect a carriage return, only one switch (SW1) attached to PA5 need be on. To display characters on the top right-hand corner of the screen (scan mode), SW2 attached to PA7 must be on.

Finally, to print the character currently displayed, both the scan switch SW2 (PA7) and the print switch SW3 (PA6) must be on.

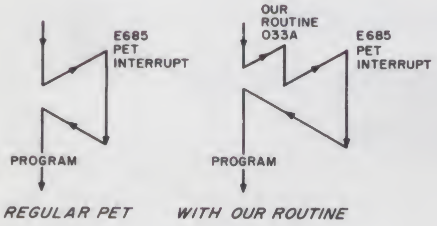
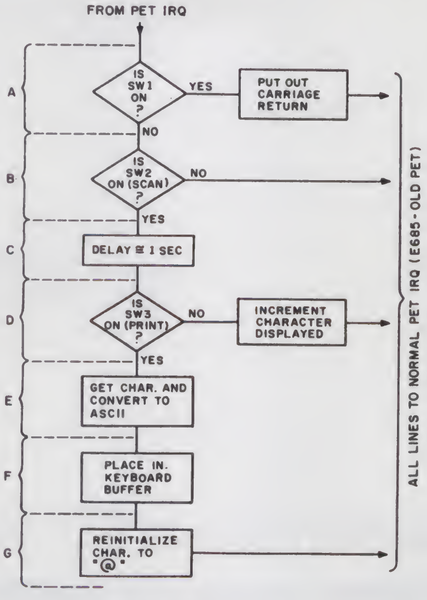


Fig. 1. Special insert program modification.



FROM PET IRQ
A
IS SW1 ON ?
YES
PUT OUT CARRIAGE RETURN
NO
B
IS SW2 ON (SCAN) ?
NO
YES
C
DELAY ≅ 1 SEC
D
IS SW3 ON (PRINT) ?
NO
INCREMENT CHARACTER DISPLAYED
YES
E
GET CHAR. AND CONVERT TO ASCII
F
PLACE IN. KEYBOARD BUFFER
G
REINITIALIZE CHAR. TO "@"
ALL LINES TO NORMAL PET IRQ (E685-OLD PET)

Fig. 2. Program flowchart.

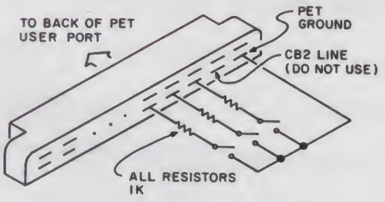


Fig. 3. Grounding through a 1k resistor.

You can do the same with only two switches: one for scan and one for print. You could carriage return when a special character is displayed. But the scan rate must be slow (each character is displayed for about one second), and so the third switch for a carriage return lets you do this at any time. Of course, this makes the hardware more complex. Fig 2. is a flowchart of the program.

Details of Program

Block A, lines 160 to 180 of assembly. The accumulator is loaded with the contents of the PET user port (port A of the 6522 VIA at address E84F). A check is made to see if the byte here is equal to DF (11011111). That is, is bit 5 zero? If it is, indicating SW1 is on (carriage return), you jump to line 580.

At line 580 the X-register is loaded with the number of characters in the keyboard buffer and the accumulator is loaded with a carriage return (0D).

The VIA register is reread until it no longer shows a carriage return (SW1 released). The accumulator is then placed in the keyboard buffer, thus effecting a carriage return. This method of rereading the VIA port acts as a debounce and ensures that only one carriage return is done when the switch is released.

Address correspondence to Frank Donato, 1306 Wedgewood Drive, Sudbury, Ontario P3A 3E2, Canada.

Note that the keyboard buffer holds only ten characters so that when the buffer pointer is ten, it must be reset to 0. After this you jump to the regular PET interrupt (line 690).

```
                     0010 ;********************************
                     0020 ;*** JOYSTICK PROGRAMMER FOR ***
                     0030 ;*** THE CBM P.E.T.          ***
                     0040 ;*** BY FRANK DONATO         ***
                     0050 ;*** DEC 30, 1980            ***
                     0060 ;********************************
                     0070 ;
                     0080 ;
                     0090 COUNT       .DE $03B3 ;TIMING COUNT
                     0100 PORT        .DE $E84F ;USER PORT
                     0110 INT         .DE $E685 ;PET INTERRUPT
                     0120 SCREEN      .DE $804F ;WHERE CHAR IS DISPLAYED
                     0130 KBUFF       .DE $020F ;KBD BUFFER
                     0140 NCHAR       .DE $020D ;NO OF CHRS IN KBD BUF
                     0150             .BA $033A  ;LOCATION OF PROGRAM
033A- AD 4F E8       0160             LDA PORT  ;LOAD PORT VALUE
033D- C9 DF          0170             CMP #DF  ;IS THERE A CR ?
033F- F0 53          0180             BEQ OUT1  ;IF SO OUTPUT ONE
0341- C9 7F          0190             CMP #7F  ;IF NOT CHECK FOR SCAN
0343- D0 40          0200             BNE NSCAN  ;IF NOT GO TO NSCAN
0345- A9 03          0210             LDA #03  ;IF SCAN START LOOP
0347- 8D B3 03       0220             STA COUNT
034A- A2 FF          0230 LP1         LDX #FF
034C- A0 FF          0240 LP2         LDY #FF
034E- 88             0250 LP3         DEY
034F- D0 FD          0260             BNE LP3
0351- CA             0270             DEX
0352- D0 F8          0280             BNE LP2
0354- CE B3 03       0290             DEC COUNT
0357- D0 F1          0300             BNE LP1  ;END OF TIMING LOOP
0359- AD 4F E8       0310             LDA PORT  ;GET PORT VALUE
035C- C9 3F          0320             CMP #3F  ;DO WE PRINT ?
035E- F0 06          0330             BEQ PRNT  ;IF SO GO TO PRNT
0360- EE 4F 80       0340             INC SCREEN  ;IF NOT INC SCREEN CHAR
0363- 4C 85 E6       0350             JMP INT  ;AND GO TO REG INTERRUPT
0366- AD 4F 80       0360 PRNT        LDA SCREEN  ;GET CHAR TO PRINT
0369- 48             0370             PHA  ;START OF ASCII CONVERSION
036A- 29 20          0380             AND #20
036C- D0 04          0390             BNE AS2
036E- 68             0400             PLA
036F- 09 40          0410             ORA #40
0371- 48             0420             PHA
0372- 68             0430 AS2         PLA
0373- 29 7F          0440             AND #7F  ;END OF ASCII CONVERSION
0375- AE 0D 02       0450             LDX NCHAR ;GET # OF CHRS IN BUF
0378- 9D 0F 02       0460             STA KBUFF,X ;STORE CHR IN BUF
037B- E8             0470             INX  ;INC THE POINTER
037C- E0 0A          0480             CPX #0A  ;ARE THERE 10 ?
037E- D0 02          0490             BNE NFL  ;BRANCH IF NOT FULL
0380- A2 00          0500             LDX #00  ;IF FULL RESET TO 0
0382- 8E 0D 02       0510 NFL         STX NCHAR  ;PUT POINTER BACK
0385- A9 00          0520 NSCAN       LDA #00 ;RESET CHAR
0387- 8D 4F 80       0530             STA SCREEN  ;PUT BACK ON SCREEN
038A- AD 4F E8       0540 CHK         LDA PORT  ;CHECK PORT
038D- C9 63          0550             CMP #63  ;IS SCAN & PRINT STILL ON ?
038F- F0 F9          0560             BEQ CHK  ;KEEP CHECKING IF SO
0391- 4C 85 E6       0570             JMP INT ;IF NOT TO INT.
0394- AE 0D 02       0580 OUT1        LDX NCHAR ;GET POINTER TO BUF
0397- A9 0D          0590             LDA #0D  ;LOAD A WITH A CR
0399- 9D 0F 02       0600             STA KBUFF,X  ;PUT OUT THE CR
039C- E8             0610             INX  ;INCREMENT POINTER
039D- AD 4F E8       0620 CHK2        LDA PORT  ;GET PORT VALUE
03A0- C9 DF          0630             CMP #DF  ;IS A CR STILL THERE
03A2- F0 F9          0640             BEQ CHK2  ;IF SO KEEP CHECKING
03A4- E0 0A          0650             CPX #0A  ;10 CHARS IN BUFFER?
03A6- D0 02          0660             BNE STOR  ;PUT POINTER BACK IF NOT
03A8- A2 00          0670             LDX #00  ;OTHERWISE RESET POINTER
03AA- 8E 0D 02       0680 STOR        STX NCHAR  ;POINTER IS BACK
03AD- 4C 85 E6       0690             JMP INT  ;TO PET INTER
                                      .EN
LABEL FILE:  [ / = EXTERNAL ]

/COUNT=03B3              /PORT=E84F               /INT=E685
/SCREEN=804F             /KBUFF=020F              /NCHAR=020D
LP1=034A                 LP2=034C                 LP3=034E
PRNT=0366                AS2=0372                 NFL=0382
NSCAN=0385               CHK=038A                 OUT1=0394
CHK2=039D                STOR=03AA
//
0000
```

Program listing.

Block B, lines 190 to 200. If there is no carriage return, you check for a scan. You check the accumulator to see if PA7 is on (indicating scan). If not, you branch to line 520 where you reset the displayed character to @ and then jump to the regular PET interrupt (lines 570).

Note that checking the port (lines 540–560) has no effect is this case because the scan and print switches are not both on.

Block C, lines 210 to 300. If the scan switch is on (SW2), you wait in a loop effected by loading the X and Y registers with FF and decrementing them. Also, you use location 03B3 as a counter to do this three times. (This could be changed to vary the time that each character is displayed.)

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Block D, lines 310 to 350. After the loop, you load the accumulator with the A port, and check if SW2 and SW3 are on by comparing with 3F (this would indicate print the character displayed). If not, you increment the value of the displayed character and jump to the PET interrupt (this is scan condition only; SW2 on and SW3 off).

Block E, lines 360 to 570. If both SW2 and SW3 are on, (indicating print condition), you jump to line 360. Here the accumulator is loaded with the screen code for the character displayed. It is converted to ASCII by the routine in lines 370 to 440. The X-register is loaded with the number of characters in the keyboard buffer, and then the accumulator (now ASCII value) is stored in the keyboard buffer. The screen character is now reset to @. The VIA port is reread and the program does not continue until the switches are released. Again, this provides debounce and prevents multiple prints. As soon as the switches are released, the program jumps to the PET interrupt (line 570).

Note that if none of the switches are on, that is, if the joystick is in the center position, the PET acts normally except the character @ is at the top right-hand corner.

Hardware

The hardware was probably the most difficult part of this project. Since the PET resets the VIA so that the A port is normally on input and at +5 V, to sense a switch closure, the line involved would have to be grounded. This is done through a 1k resistor. The schematic in Fig. 3 shows this modification.

Note that PA5, PA6 and PA7 are located on the bottom part of the user port as in Fig. 4.

The three 1k resistors are soldered to the bottom of the connector and lines from these go to three microswitches sandwiched between two plates. A flat bar of aluminum is pivoted between these and acts as the joystick (see Fig. 5).

Note that SW2 and SW3 are set so that, as the joystick is moved, SW2 is on first; then, by moving the joystick a bit more, SW3 also goes on. This is done by bending the microswitch levers.

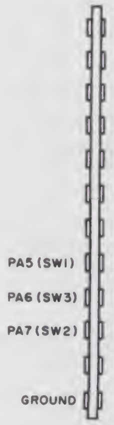

Fig. 4.

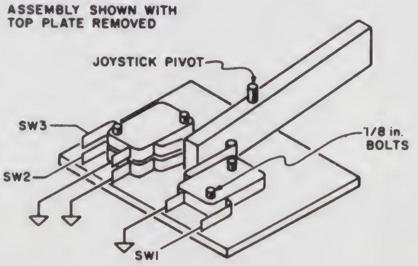

Fig. 5.

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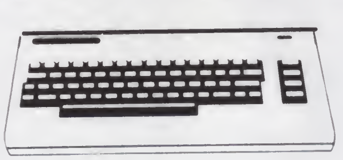

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After suitable adjustment of the joystick (the switches can be checked with an ohmmeter), the program can be tested. Of course, the program can be tested without the complexity of the above hardware by attaching some simple switches, as in Fig. 3.

Implementation

To implement the program the following steps should be taken:

1. The joystick is connected to the PET user port.
2. The main program is written in the second cassette buffer starting at 033A. This can be done with "TIM" or in the case of a new PET, the machine-language monitor (POKEs from BASIC could also be used).
3. The interrupt vector is changed to point to 033A, using TIM or the monitor (do not use POKEs).

On the old PET this is done by changing locations 0219–021A from 85E6 to 3A03, respectively, 0090–0091 from E62E to 3A03, respectively, on the new PETs, or 0090–0091 from 55E4 to 3A03 for PETs with 4.0 BASIC. Of course nothing happens except the character @ is displayed on the top right-hand corner.

When the paddle is moved so that SW2 is activated, the character should start changing. When the desired character is shown, move the lever further so that SW3 is also activated. When the paddle is released, the character should appear at the cursor position and the character on the screen should revert back to @. We can continue scanning and printing by repeating the above procedure.

Once the line is completed, move the paddle so that SW1 is activated. This will cause a carriage return and move the cursor to the next line.

For example, using the above procedure, if a line is filled with ?3*4 and a carriage return is now done (SW1 on), the PET should print 12. It should then automatically print READY. In short, it acts like a normal PET.

	Old PET	New PET	4.0 BASIC
INT	E685	2EE6	E455
KBUFF	020F	026F	026F
NCHAR	020D	009E	009E

Table 1.

Note that the listing is for an old PET. For new PETs, addresses to be changed are shown underlined in the listing and are shown in Table 1.

Conclusion

One disadvantage of the above is the speed of programming. It is slow. However, it opens opportunities for some people to express themselves.

Also, some of the above methods could be used in other programs or games.

The hardware could be varied. For example, for people with gross-motor capability only, the joystick could be mechanically altered to be less sensitive. Instead of a joystick, a foot control, head control or other means could be used.

The timing loop used in displaying the character could be varied in length to suit the programmer. The present method of displaying the character could be varied by possibly displaying all the characters in a matrix format and having a moving cursor point to each character in an X-Y coordinate mode. This would speed up character choosing but would take up more screen area.■

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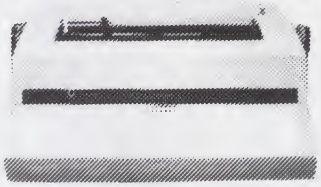

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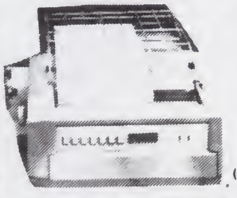

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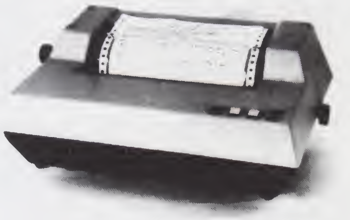

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This author put the Apple III through its paces and found more than one application for this versatile new machine.

How Does the Apple III Stack Up?

By James E. Kelley, Jr.

About four months ago an Apple III (128K) took up residence in my engineering management consulting business, accompanied by a NEC Spinwriter (5515), a second disk drive and a black and white monitor.

I needed word processing for writing and indexing procedures manuals and for preparing technical reports and marketing materials. I also wanted program development capability for producing commercial-quality software packages. My other applications are proprietary, but are intended to exploit computer graphics and to involve top executives more personally in the use of microcomputers in their businesses.

A third application, the one my friends say is the real justification, is the analysis, comparison and classification of medieval marine charts—a long-standing interest of mine.

The Bare Bones

What comes with the Apple III? There is an owner's guide with system utilities disk, a standard devices drivers manual with Apple II emulation disk, an Apple Business Basic reference manual with system disk, Apple II DOS manual with DOS 3.3 system master and DOS 3.3 BASIC disks, two VisiCalc manuals with sampler and system disks, a system demonstration disk and two blank disks.

That is not very much. But I knew in advance that I'd be a pioneer with the new machine, and would have a lot of development work to do.

When I placed my order last fall I expected to get Apple's word processor with the equipment. I understand delivery has been delayed until 1982! Since I really needed a word processor, my dealer recommended Muse Software's Supertext for the interim. This package was developed for Apple II, but fortunately it works under the emulator.

I have been using this word processing package for several months, and although it's doing the job, it's not something I want to live with forever. Using control characters for uppercase letters and other functions is certainly awkward, and it's inappropriate for the Apple III. I have to insert four disks just to get started each session. The package is unforgiving if you accidentally hit the wrong key under emulation, so frequent saves are your only insurance against redoing large blocks of text.

Getting Started

With a little instruction from the dealer I started wading through the manuals. I soon found that you need to know something about the Apple II—the manual writers tacitly assume that the reader has experience with the earlier machine. Be sure to buy some of the Apple II manuals, especially the Applesoft and the Apple II reference manuals.

One of the quickest ways to learn the fundamentals of this equipment is to print out and study a copy of the various BASIC programs that come on the demonstration and the Apple Business Basic disks. They are mostly well-documented with remarks. You can follow what they do by blocking off sections of the programs with END statements and then executing them. There are a number of demos in Integer and Applesoft BASIC on the DOS 3.3 system master which are also useful to print out and study.

There is a helpful Pascal subroutine (READCRT.INV) on the BASIC disk which reads the Text mode console screen. To my knowledge, none of the reference manuals tells how to do this, or even refers to this subroutine.

Plaudits

I was concerned that reading screen text for long periods would bother my eyes, but this has not happened. I like the 80-character per line format, with upper- and lowercase letters. It is much superior to Apple II's 40-character format.

The Apple III provided my first experience with interactive programming. It's great—I've never written and debugged programs so rapidly. Every programmer should have this facility. Your debugged product can be compiled into machine language later on.

Address correspondence to James E. Kelley, Jr., 7602 Spring Ave., Melrose Park, PA 19106.

The edit feature is especially convenient. You can move the cursor all over the screen so you can assemble lines of coding from previously keyed material or insert corrections at will.

Text and Program Manipulation

The string manipulation features of Apple II have been extended on the Apple III to include HEX$ (decimal to hexadecimal conversion), TEN (hex to decimal), INSTR (first position of a substring) and SUB$ (substring replacement). The related CONV(ert) commands, also new, permit all datatype conversions among real, integer, string and long integer expressions.

A really nice feature of the Apple Business Basic is the ability to LIST programs, or sections of them, to a Text file and then to read them back with an EXEC(ute) command. This lets the programmer manipulate programs within BASIC. For instance, I store useful subroutines as Text files, to be called when assembling a program by the appended utility, called PATCH, which is temporarily stored at high number-line positions. This utility renumbers the subroutine and inserts it in the program being assembled (using the EXEC command). Indeed, PATCH itself is called as needed using the EXEC command, and then deleted when no longer needed.

Unfortunately, the LIST and DEL commands currently accept only explicit values of line numbers and not variables whose values can be substituted under program control. Further, the DEL command does not function in deferred mode, but requires direct operator involvement in utilities using it. The EXEC command works in deferred mode if the file pathname is placed in quotes (not mentioned in the manuals).

Since the EXEC command imitates keyboard input operation, the statements need not be in ascending sequence in the text file. This makes a limited form of numeric sorting possible. Generate BASIC REM statements, where the statement numbers are the sort keys, and the records or record identifiers are stored behind the REM. Distribute these statements to a text file and read back using an EXEC command. Voila! They are in sort order in the instruction memory. Now list them back to a text file and input them to a file for further processing under BASIC program control.

I have also used the program memory for dated text items (e.g., bibliographic references, follow-up notes). The date (or reasonable facsimile) provides the line number, a REM command avoids syntax tests, an additional digit or two provide a secondary classification (e.g., type of bibliographic item, individual involved or type of follow-up action), and finally the text in English (all in under 255 characters). This information is saved in a Text file, and read back using the EXEC command, to be updated just as you would correct a BASIC program using the cursor controls. A simple print program, selecting on the secondary classification if desired, provides up-to-date bibliographic or follow-up lists by individual or function.

Quibbles

For an old FORTRAN programmer, the Apple Business Basic I/O statements are unnecessarily confusing and unwieldly. The use of INPUT/PRINT and READ/WRITE commands depends on the type of file addressed, and the punctuation of the variable list (commas and semicolons) varies with the device type. I'm forever making syntax errors. Handling of arrays during I/O is also inconvenient compared to FORTRAN. I'm not sure yet what strategy to follow in designing file layouts to get the best speed of operation. More information on how BASIC handles I/O commands internally would be helpful here.

A simple program listing requires typing many characters, and I am forever doing it wrong. Here's the full sequence:

open#3,".printer":output#3:list:output#0:close#3:end.

I usually put this sequence at the end of my programs for easy call with a GOTO. I suppose these complications can be justified by the flexibility they provide—like the abominable JCL (job control language) of the IBM 360s and 370s.

In my shop, certain file numbers are standard, like standard device numbers on the old IBM systems (e.g., 1 = console [keyboard and screen], 3 = printer; 4 = graphics, etc.). When I pick up a piece of coding and read PRINT#3 I know automatically that the NEC Spinwriter is the device involved.

Big Disappointment

My biggest disappointment is being locked out of the system. No way is currently provided for programming in machine language. POKE, PEEK and CALL are not in Apple Business Basic's vocabulary. BASIC is fine for interactive operations at the console. But because it's interpretive, it's much too slow to exploit Apple III's intrinsic capabilities for number crunching, array handling or involved string manipulation. I like the idea of writing mainlines and most I/O and other overview functions in BASIC (for easy debugging at the console), while writing the inner loops (where time counts) in machine or a compiled language (e.g., Pascal,

Program listing. PATCH programming aid.

```
63000  REM  ************************************************************
63005  REM  * 5/29/81                                         VER 0.1  *
63010  REM  *                    ***  PATCH  ***                       *
63015  REM  *                                                          *
63020  REM  *             An APPLE III Programer's Aid                 *
63025  REM  *                                                          *
63030  REM  *                     Developed by:                        *
63035  REM  *                                                          *
63040  REM  *                 JAMES E. KELLEY, JR.                     *
63045  REM  *                 Melrose Park, Penna.                     *
63050  REM  *                                                          *
63055  REM  *                                                          *
63060  REM  ************************************************************
63065  DIM stmt$(200):GOTO 63620
63070  :
63075  REM   ***  PULL OUT STATEMENT #  ***
63080  line$=""
63085  line$=line$+b$:IF a%=LEN(string$) THEN 63110
63090  a%=a%+1:b$=MID$(string$,a%,1)
63095  IF b$<"0" OR b$>"9" THEN 63110:ELSE 63085
63100  :
63105  REM   ***  CALC EQUIVALENT STMNT #  ***
63110  FOR i=1 TO lim:IF line$=stmt$(i) THEN 63120
63115    NEXT:nline$=line$:RETURN
63120  nline$=STR$(min+dif*(i-1)):RETURN
63125  :
63130  REM   ***  ASSEMBLE OUTPUT STRING  ***
```

More

FORTRAN).

Pascal, when it's available, is supposed to substitute for coding in machine language. Or perhaps it will provide the means to get directly at the 6502A and give the user true ownership and control of his equipment.

For me, being locked into BASIC exclusively means deferring the development of commercial-quality systems. The graphics die in BASIC. Image development is too slow for interactive graphics—rubber-banding and the like. At least I'm not smart enough to do these things effectively with the currently available facilities for Apple III.

Glitches

Three valuable Applesoft program statements have been omitted in Apple Business Basic: FLASH (causes text to blink), ROT(ate) (a shape) and SCALE (a shape). SCALE is still in the vocabulary, but it now relates to formatting output for printing.

The first version of the BASIC system has serious bugs in the graphics package. When you use mode 2 (high-resolution) to plot data or to read the screen in the horizontal range of 512, the image is recorded in the range 256. I first encountered this when dumping a picture on the demonstration disk from the mode 2 buffer to the printer while experimenting with the NEC Spinwriter's graphics. I thought I had an error in my program. But the problem also arises when you plot curves on the high-resolution screen.

The Newfont and Drawimage features of the graphics package do not give correct results either. If you try the explanatory example in the manual you'll find this to be true.

Comments on PATCH

PATCH is to be stored as a text file and called by the statement EXEC .D2/PATCH. It is read into memory without disturbing the program in residence unless it has statement numbers of 63000 or more. Enter PATCH with a GOTO 63000. The menu will be displayed (lines 63615–63675).

In operation, PATCH is pretty well self-explanatory. However, I'm sure it won't handle all possible error conditions, although those which I commonly make are programmed to give me a second chance.

Four working options are available in PATCH as currently written:

Listing continued.

```
63135  out$=LEFT$(string$,m%)+nline$:d%=LEN(string$)-m%-LEN(line$)
63140  IF d%<=0 THEN string$=out$:RETURN
63145  string$=out$+RIGHT$(string$,d%):RETURN
63150  :
63155  REM   ***  Process THEN, ELSE & USING  ***
63160  a%=INSTR(string$,c$,i%):IF a%=0 THEN RETURN:REM No more THEN's
63165  b$=MID$(string$,a%+j%,1):IF b$<"0" OR b$>"9" THEN i%=a%+j%:GOTO 6316
       0
63170  a%=a%+j%:m%=a%-1:GOSUB 63080:GOSUB 63135
63175  IF d%>j% THEN i%=LEN(string$)-d%:GOTO 63160
63180  RETURN
63185  :
63190  REM   ***  Process GOTO, GOSUB  ***
63195  a%=INSTR(string$,c$,i%):IF a%=0 THEN RETURN:REM No more GOTO's
63200  b$=MID$(string$,a%+j%,1):IF b$<"0" OR b$>"9" THEN i%=a%+j%:GOTO 6319
       5
63205  a%=a%+j%:m%=a%-1
63210  GOSUB 63080:GOSUB 63135
63215  IF d%<=0 THEN RETURN
63220  m%=m%+LEN(nline$)+1:b$=MID$(string$,m%,1)
63225  IF b$="," THEN a%=m%+1:b$=MID$(string$,a%,1):GOTO 63210
63230  IF d%>j% THEN i%=LEN(string$)-d%:GOTO 63195
63235  RETURN
63240  :
63245  REM   ***  MAIN LINE  ***
63250  :
63255  INPUT#6;string$:IF LEN(string$)<=0 THEN PRINT#7;string$:GOTO 63255
63260  :
63265  REM  Process STATEMENT #
63270  a%=1:line$="":GOSUB 63090:d%=LEN(string$)-LEN(line$)-1
63275  string$=blnk$+nline$+RIGHT$(string$,d%)
63280  i%=1:c$="THEN":j%=5:GOSUB 63160:REM "THEN"
63285  i%=1:c$="ELSE":j%=5:GOSUB 63160:REM "ELSE"
63290  i%=1:c$="GOTO":j%=5:GOSUB 63195:REM "GOTO"
63295  i%=1:c$="GOSUB":j%=6:GOSUB 63195:REM "GOSUB"
63300  i%=1:c$="USING":j%=6:GOSUB 63160:REM "USING"
63305  PRINT#7;string$:GOTO 63255:REM Get next input string
63310  :
63315  REM   ***  INITIALIZE  ***
63320  work$=".d2/renumworkfile":ON ERR GOTO 63450:CREATE work$, TEXT
63325  OFF ERR:lim%=200:qt$=CHR$(34):blnk$=CHR$(32)
63330  PRINT:PRINT"Is Routine Currently in MEMORY (Y/N)";:INPUT q$
63335  jmp=1:IF q$="y" THEN jmp=2:x=1:GOTO 63470:REM Go CAPTURE Routine
63340  PRINT:PRINT:INPUT"KEY Pathname of SOURCE Routine: ";name$
63345  :
63350  REM   ***  SET UP STMT$ TABLE  ***
63355  i=1:ON ERR GOTO 63455
63360  OPEN#6 AS INPUT,name$:OFF ERR:ON EOF#6 GOTO 63375
63365  INPUT#6;string$:IF LEN(string$)<=0 THEN 63365
63370  a%=INSTR(string$,blnk$,2):stmt$(i)=MID$(string$,2,a%-2):i=i+1:GOTO 6
       3365
63375  CLOSE:OPEN#6 AS INPUT,name$
63380  ON EOF#6 GOTO 63530
63385  lim=i-1:OPEN#7 AS OUTPUT,work$
63390  ON ERR GOTO 63425
63395  PRINT:INPUT"KEY STARTING STATEMENT & STEP: ";min,dif:OFF ERR
63400  a=min+lim*dif:IF min<1 OR dif<1 THEN 63420
63405  IF min-INT(min)>0 OR dif-INT(dif)>0 THEN 63420
63410  IF a>63999 THEN PRINT:PRINT"New Line #'s EXCEED Capacity Limit of 63
       999":GOTO 63390
63415  GOTO 63255
63420  PRINT:PRINT"POSITIVE Integers PLEASE!!":GOTO 63390
63425  PRINT:PRINT"Illegal Quantity":GOTO 63395
63430  :
63435  REM   ***  CLOSING ROUTINE  ***
63440  CLOSE:PRINT"DONE -- RENUMBERED ROUTINE INSERTED"
63445  EXEC".d2/renumworkfile":END
63450  DELETE".d2/renumworkfile":GOTO 63320
63455  PRINT:PRINT; TAB(10);"<<< Pathname "name$" does NOT Exist >>>":PRINT
       :INPUT"Press ANY Key FOR MENU";q$:GOTO 63620
63460  :
63465  REM  ***  CAPTURE ROUTINE AS TEXT FILE  ***
63470  n$=".d2/captureworkfile":ON ERR GOTO 63515
63475  CREATE n$, TEXT:OFF ERR:OPEN#8,n$
63480  s$=" 63505 list ":t$=" del "
63485  GOSUB 63860
63490  PRINT:PRINT"EXECUTE the Following TWO Statements in IMMEDIATE Mode"
63495  PRINT:PRINT;s$:PRINT" goto 63500":PRINT CHR$(11);CHR$(11);CHR$(11);:
       END
63500  OUTPUT#8
63505  LIST 63000 TO 63999
63510  OUTPUT#0:CLOSE#8:name$=n$:ON x GOTO 63355,63755,63840
63515  DELETE n$:GOTO 63470
63520  :
63525  REM   ***  CLOSING ROUTINE  ***
```

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List Routine. This can be done in unedited format as you would using the LIST command, or in edited format as the appended listing of PATCH illustrates. If many instructions are crammed into a single statement, you may have trouble getting wraparound on the printer, and difficulty reading the results when text and statement numbers appear in the same column position. The edited listing is obtained by capturing the program lines (asked for by PATCH) in a text file. They are then read back, edited and printed.

Capture Routine as Text File. Since this function is used as a subroutine for the other functions, I provided it as an option. I've used it for saving pieces of programs for editing as more general subroutines, or for saving information in DATA statements.

Extract, Renumber, Reinsert Routine. This is the principle function of PATCH. Input routines may be in a text file on disk or already resident in memory; the program asks you to specify. If the routine is in memory you are asked to identify the lines (they need not be contiguous groups of statements). You are then asked to specify the new starting statement number and the stepping constant. The routine is renumbered and placed in a text file, and the program asks whether you want to rename that file for later use. It then asks if you want to load the renumbered routine into memory. If the routine was taken from the program in memory, you are asked if you want to first delete the lines from which it derived. If you elect to load the routine, you stop at an END statement.

Reinitiate PATCH if you want the menu for more operations. (EXEC uses the console, so there is confusion when PRINT statements are performed while EXEC is doing its thing.) In the other cases you get back to the menu automatically.

Lines 63075–63455. These lines cover the subroutines for renumbering statements, including substituting the proper new numbers in GOTOs, GOSUBs, etc. Each new statement to be processed is picked up in line 63255. Each case requiring a new number is identified in lines 63265–63300. Other cases might be added (e.g., LIST). The processed statement is transferred to disk in line 63305. Setting up to do the renumbering is done in lines 63320–63455.

Lines 63465–63515. Here is where specified statements are captured as

Listing continued.

```
 63530  CLOSE:PRINT:PRINT"Renumbered Routine is TEXT File with Pathname ";wo
        rk$
 63535  PRINT:PRINT"Do you want to SAVE this Routine with a DIFFERENT Pathna
        me (Y/N)";:INPUT q$
 63540  IF q$="y" THEN 63555
 63545  PRINT:PRINT"Do you want to LOAD "work$" (Y/N)";:INPUT q$
 63550  IF q$="y" THEN 63575:ELSE 63620
 63555  PRINT:PRINT"Key NEW Pathname for ";work$;:INPUT newname$:ON ERR GOTO
         63570
 63560  RENAME work$,newname$:OFF ERR
 63565  SWAP work$,newname$:GOTO 63545
 63570  PRINT:PRINT"   <<<  DUPLICATE or BAD Pathname - REPEAT  >>>":GOTO 63
        555
 63575  ON jmp GOTO 63605,63580
 63580  PRINT:PRINT"Do you want to DELETE the Captured Lines from Memory FIR
        ST (Y/N)";:INPUT q$
 63585  IF q$="n" THEN 63605
 63590  PRINT:PRINT"EXECUTE the Following TWO Statements in IMMEDIATE Mode"
 63595  PRINT:PRINT;t$:PRINT" goto 63605":PRINT CHR$(11);CHR$(11);CHR$(11);:
        END
 63600  DEL 1 TO 62999:REM Executed in IMMEDIATE Mode
 63605  EXEC work$:END
 63610  :
 63615  REM  ***  DISPLAY MENU  ***
 63620  HOME:VPOS=5:PRINT; TAB(15);"PATCH MENU"
 63625  PRINT:PRINT"1. LIST ROUTINE (Unedited)"
 63630  PRINT:PRINT"2. LIST ROUTINE (Edited)"
 63635  PRINT:PRINT"3. CAPTURE (Save) ROUTINE as TEXT File"
 63640  PRINT:PRINT"4. EXTRACT, RENUMBER, REINSERT ROUTINE"
 63645  PRINT:PRINT"5. QUIT"
 63650  PRINT:PRINT; TAB(10);"< MAKE SELECTION >";:INPUT s
 63655  IF s=<0 THEN 63620
 63660  PRINT:PRINT"Press <RETURN> to do TASK #"s"";:INPUT q$
 63665  IF ASC(q$)<>-1 THEN 63620
 63670  IF s=>5 THEN PRINT"BYE!":END
 63675  ON s GOTO 63690,63745,63835,63320
 63680  :
 63685  REM  ***  LIST ROUTINES  ***
 63690  PRINT:PRINT"ADJUST Printer and hit <RETURN>";:INPUT q$
 63695  PRINT:PRINT"List WHOLE Program (Y/N)";:INPUT q$
 63700  OPEN#3,".printer":IF q$="n" THEN 63710
 63705  OUTPUT#3:LIST 1-62999:OUTPUT#0:GOTO 63620
 63710  s$=" 63725  OUTPUT#3:LIST ":t$="":GOSUB 63860
 63715  PRINT:PRINT"EXECUTE the Following TWO Statements in IMMEDIATE Mode"
 63720  PRINT:PRINT;s$:PRINT" goto 63725":PRINT CHR$(11);CHR$(11);CHR$(11);:
 63725  OUTPUT#3:LIST 1 TO 63999:REM Executed in IMMEDIATE Mode
 63730  OUTPUT#0:CLOSE#3:GOTO 63620
 63735  :
 63740  REM  ***  EDITED LISTINGS  ***
 63745  PRINT:PRINT"ADJUST Printer and hit <RETURN>";:INPUT q$
 63750  OPEN#3,".printer":page=1:x=2:GOTO 63470:REM Go CAPTURE Routine
 63755  OPEN#8 AS INPUT,".d2/captureworkfile":ff$=CHR$(12):line=0:bb=0:sp$=C
        HR$(32):bl$=sp$
 63760  lf$=CHR$(10):cr$=CHR$(13):ON EOF#8 PRINT#3;lf$;cr$;:CLOSE:DELETE n$:
        GOTO 63620
 63765  PRINT#3;cr$;bl$;" Page "page"";cr$;lf$;lf$;:page=page+1:line=line+2:
        bl$=sp$
 63770  INPUT#8;string$:aa=INSTR(string$," ",2)+1
 63775  IF LEN(string$)>75 THEN 63795
 63780  PRINT#3;cr$;lf$; SPC(bb+1);string$;:IF line<54 THEN 63790
 63785  line=0:bl$=ff$:bb=0:GOTO 63765
 63790  line=line+1:bb=0:GOTO 63770
 63795  FOR i=76 TO 65 STEP-1
 63800    a$=MID$(string$,i,1):IF a$<>" " THEN 63810
 63805    NEXT i
 63810  PRINT#3;cr$;lf$; SPC(bb+1);LEFT$(string$,i);:line=line+1:bb=aa
 63815  IF LEN(string$)-i=<0 THEN 63770
 63820  string$=RIGHT$(string$,LEN(string$)-i):GOTO 63775
 63825  :
 63830  REM   ***  SAVE ROUTINE AS TEXT FILE  ***
 63835  x=3:GOTO 63470:REM Go CAPTURE Routine
 63840  PRINT:INPUT"Key PATHNAME for the ROUTINE";newname$:ON ERR GOTO 63570
         63845  RENAME n$,newname$:OFF ERR:GOTO 63620
 63850  :
 63855  REM   ***  LIST/DEL RANGE LIMITS  ***
 63860  PRINT:PRINT"Key FIRST Line #  ";:INPUT l1
 63865  PRINT"Key SECOND Line # ";:INPUT l2
 63870  IF l1>l2 OR l1<0 OR l2>63999 THEN PRINT:PRINT"   <<<  ILLEGAL LINE #
        'S  -  REPEAT  >>>":GOTO 63860
 63875  s$=s$+CONV$(l1)+" to "+CONV$(l2)+":":t$=t$+CONV$(l1)+" to "+CONV$(l2
        )+":"
 63880  PRINT"Any more Sections to Pull Out (Y/N)";:INPUT q$
 63885  IF q$="y" THEN s$=s$+"list ":t$=t$+"del ":GOTO 63860
 63890  RETURN
```

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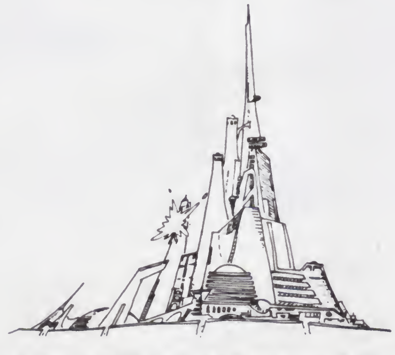

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MAXI-PROS also has sophisticated file capabibilities. It can access a file for names and addresses, stop for inputs, and print form letters. It has file merging capabilities so that it can store and combine paragraphs and pages in any order.

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a text file. Line 63505 is created in line 63495 by printing it followed by a GOTO (to get back into PATCH again). You are instructed to execute the two lines from the console by running the retype key (right arrow) over them individually, hitting return each time.

Lines 63525–63605. Here are some miscellaneous subroutines used at the end of a renumbering exercise. Particularly note that line 63600, which deletes the lines extracted from the resident program, is set up on the console for execution in Immediate mode (as with line 63505, and again in line 63725).

Lines 63685–End. The listing options are managed here. The width of a printed line is controlled in line 63775; control of lines per page is in line 63780.

For accommodating smaller memories there are numerous ways to reduce the size of PATCH, an exercise I will leave to the interested programmer. Other functions might be added to this utility, such as compressing the number of line numbers or copying individual files from one disk to another.■

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With this H89 program that generates professional-looking order forms, all you have to do is sign the form and send it in.

Made-to-Order Business Forms

By Marilyn H. Deibert

Forms is designed to make a professional-looking order form, ready for mailing. Although the program is written for the Heath H-89, it can, with minor modifications, be used with any computer-printer combination. The screen graphics are used to enhance the input of data and can be deleted with no ill effects to the program.

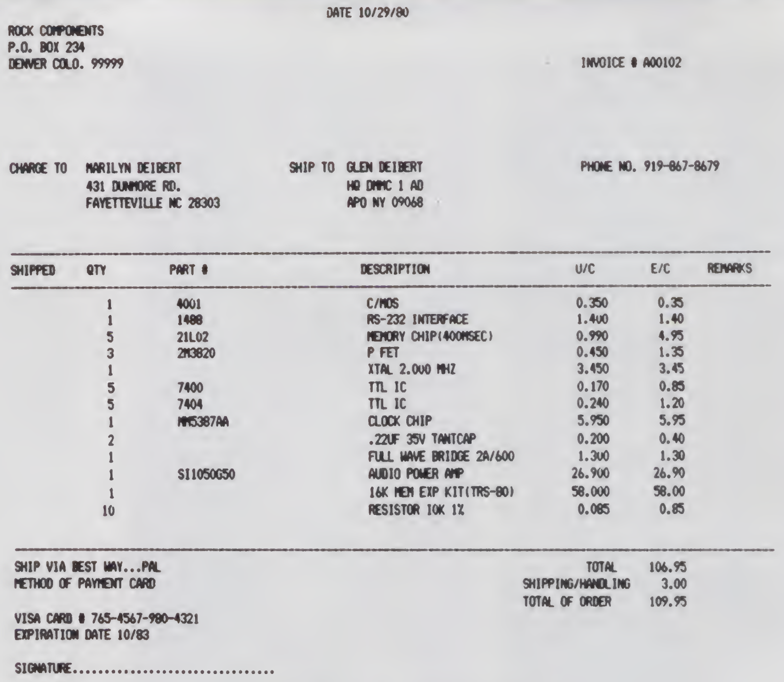
The program has the following features:

- ●Entry of ''ship to'' address.
- ●If the ''charge to'' address is different than the ''ship to'' address, it can be entered.
- ●Entry of your invoice number.
- ●Entry of vendor name and address.
- ●Entry of various methods of payment (bank card, check, etc.).
- ●Entry of various types of shipping charge rates (flat rate, percentage of order or none).
- ●Entry of tax rate if applicable.
- ●Entry of specific method of shipment (UPS, Bestway, etc.).
- ●Error correction of entries prior to printing. Entries can be changed or additional entries can be made as an afterthought.
- ●Entry of 18 items to a form.
- ●Complete interaction between the user and the computer.

The question/answer format makes the program easy to use. After the printer has typed the form, you need only to sign it if a bank card is used, and then mail it.

Using the Program

To use the program, the only part of the run that may need clarification



```
                                   DATE 10/29/80
ROCK COMPONENTS
P.O. BOX 234
DENVER COLO. 99999                                                      INVOICE # A00102



CHARGE TO   MARILYN DEIBERT              SHIP TO  GLEN DEIBERT                PHONE NO. 919-867-8679
            431 DUNMORE RD.                       HQ DMMC 1 AD
            FAYETTEVILLE NC 28303                 APO NY 09068

-----------------------------------------------------------------------------------------------
SHIPPED    QTY        PART #                DESCRIPTION                U/C      E/C    REMARKS
-----------------------------------------------------------------------------------------------
            1         4001                  C/MOS                      0.350    0.35
            1         1488                  RS-232 INTERFACE           1.400    1.40
            5         21L02                 MEMORY CHIP(400MSEC)       0.990    4.95
            3         2N3820                P FET                      0.450    1.35
            1                               XTAL 2.000 MHZ             3.450    3.45
            5         7400                  TTL IC                     0.170    0.85
            5         7404                  TTL IC                     0.240    1.20
            1         MM5387AA              CLOCK CHIP                 5.950    5.95
            2                               .22UF 35V TANTCAP          0.200    0.40
            1                               FULL WAVE BRIDGE 2A/600    1.300    1.30
            1         SI1050G50             AUDIO POWER AMP           26.900   26.90
            1                               16K MEM EXP KIT(TRS-80)   58.000   58.00
           10                               RESISTOR 10K 1%            0.085    0.85

-----------------------------------------------------------------------------------------------
SHIP VIA BEST WAY...PAL                                             TOTAL  106.95
METHOD OF PAYMENT CARD                                  SHIPPING/HANDLING    3.00
                                                           TOTAL OF ORDER  109.95
VISA CARD # 765-4567-980-4321
EXPIRATION DATE 10/83

SIGNATURE...............................
```

Sample run of the Forms program.

The Forms program listing, written for the Heath H-89.

```
100 REM ORDER FORM
110 REM*****FORMS******
120 MARILYN H. DEIBERT
130 REM HQ DMMC 1 AD  APO NY 09068
140 REM 2 SEPT 1981
150 REM
160 L$=CHR$(10):REM LINE FEED
170 CLEAR500
180 REM
190 REM SETS EDITING
200 U$="#####.##":U1$="####":U2$="#####.###"
210 REM
220 REM  SETS GRAPHIC PARAMETERS
230 E$=CHR$(27):E1$=E$+"E":F$=E$+"F":G$=E$+"G":Y$=E$+"Y":J$=E$+"j":K$=E$+"k":L$=E$+"K":Y1$=E$+"Y"
240 REM
250 PRINTE1$:PRINTG$
260 PRINT"THIS PROGRAM WILL ALLOW THE ENTRY OF ITEMS FOR PRINTING OF PURCHASE ORDERS.";
270 PRINT" THE ENTRIES AVAILABLE ARE QUANTITY,  DESCRIPTION, PART NUMBER & UNIT COST."
280 PRINT:PRINT"THE EXTENDED PRICE WILL BE POSTED TO THE APPROPRIATE COLUMN ON THE CRT.";
```

More

Address correspondence to Marilyn H. Deibert, HQ DMMC 1 AD, APO, NY 09068.

Program listing continued.

```
290 PRINT" AFTER   ALL ENTRIES ARE ENTERED, VERIFY THEIR ACCURACY AND MAKE ANY NECESSARY          C
ORRECTIONS."
300 PRINT:PRINT"WHEN YOU HAVE COMPLETED ALL ENTRIES, ENTER A '0' WHEN THE QUANTITY IS REQUESTED.";
310 PRINT"THEN MAKE THE PRINTER READY AND THE INFORMATION WILL DE PRINTED FOR YOU."
320 PRINT:PRINT:INPUT"PRESS 'RETURN' TO CONTINUE.";Q$
330 PRINTE1$
340 DIMA(20,3),A$(20,2)
350 REM INPUT ADDRESS DATA
360 REM
370 INPUT"TODAY'S DATE (MM/DD/YY) ";Y4$:PRINT
380 INPUT"SHIP TO NAME";N$
390 PRINT:INPUT"STREET ADDRESS";S$
400 PRINT:LINEINPUT"CITY STATE ZIP CODE ";Z$
410 PRINT:INPUT"ENTER YOUR PHONE # (999-999-9999) ";PA$
420 PRINT:INPUT"ENTER YOUR INVOICE NUMBER ";I$
430 REM PAYEE DIFFERENT FROM SHIP TO
440 PRINT:INPUT"IS THE PAYEE NAME & ADDRESS THE SAME AS THE SHIP TO (Y/N) ";Q$:IFQ$="Y"THEN490:PRINT
450 IFQ$="N"THENPRINT: INPUT"PAYEE NAME ";P7$:PRINT:INPUT"PAYEE STREET ADDRESS ";P8$:PRINT
460 LINEINPUT"PAYEE CITY STATE ZIP CODE ";P9$
470 REM
480 REM INPUT VENDOR ADDRESS
490 PRINT:PRINT:PRINT:INPUT"VENDOR NAME";N1$
500 PRINT:INPUT"VENDOR STREET ADDRESS";S1$
510 PRINT:LINEINPUT"VENDOR CITY STATE ZIP CODE ";Z1$
520 PRINT:INPUT"MODE OF SHIPMENT (UPS,BEST WAY ETC.)";M$
530 REM
540 PRINTE1$
550 REM
560 REM ALLOWS SELECTION OF PAYMENT
570 REM
580 PRINT:INPUT"METHOD OF PAYMENT (M.O.,CHECK, CARD C.O.D)";P$
590 IF P$="CARD"THEN PRINT:INPUT"WHAT TYPE CARD (VISA,MASTER CHG, ETC.)";P1$
600 IFP$="CARD" THEN PRINT: INPUT"WHAT IS YOUR CARD NUMBER ";P2$
610 PRINT:IFP$="CARD"THEN INPUT"EXPIRATION DATE (MM/YY) ";M2$
620 REM
630 REM SETS TABLE SIZE
650 REM
660 PRINTY1$:PRINTG$:REM  CLEARS GRAPHICS
670 REM
680 PRINTE1$ :  REM CLEARS SCREEN
690 REM SETS UP CRT FOR INPUT
700 PRINT" QTY";TAB(12);"PART #";TAB(28);"DESCRIPTION";TAB(49);"U/C";TAB(59);"E/C"
710 PRINTF$;
720 REM
730 REM BUILDS FORM ON CRT
740 PRINT"faaaasaaaaaaaaaaaaaasaaaaaaaaaaaaaaaaaaaaaaasaaaaaaaaaasaaaaaaaaac"
750 FORX=1TO18
760 PRINT"`";TAB(6);"`";TAB(21) ;"`";TAB(45);"`";TAB(56);"`";TAB(66);"`"
770 NEXTX
780 PRINT"eaaaauaaaaaaaaaaaaaauaaaaaaaaaaaaaaaaaaaaaaauaaaaaaaaaauaaaaaaaaad"
790 FORX=1TO18
800 PRINTJ$;
810 REM
820 REM POSITIONS CURSOR FOR PRINTING
830 REM
840 INPUT"ENTER QUANTITY  ('0' IF DONE)";A
850 IF A=0 THEN 1060 ELSE 860
860 A(X,1)=A
870 PRINTY$;CHR$(34+X);CHR$(33);USINGU1$;A(X,1)
880 PRINTK$;L$;
890 INPUT"PART NUMBER";A$(X,1)
900 PRINTY$;CHR$(34+X);CHR$(39);A$(X,1)
910 PRINTK$;L$;
920 INPUT"DESCRIPTION";A$(X,2)
930 PRINTY$;CHR$(34+X);CHR$(54);A$(X,2)
940 PRINTK$;L$;
950 INPUT"ENTER UNIT COST";A(X,2)
960 A(X,3)=A(X,1)*A(X,2)
970 PRINTY$;CHR$(34+X);CHR$(78);USINGU2$;A(X,2):PRINTK$;L$;:PRINTY$;CHR$(34+X);CHR$(89);USINGU$;A(X,
3):PRINTK$;L$;
980 REM COUNTER FOR NUMBER OF ENTRIES
990 CR=CR+1
1000 IFCR=18 THENPRINT"THERE IS A LIMIT OF 18 ITEMS PER ORDER.":INPUT"PRESS RETURN TO CONTINUE.";Q$
1010 NEXTX
1020 PRINTG$
1030 REM
1040 REM SHIPPING AND HANDLING ROUTINE
1050 REM
1060 FORX=1TOCR:A4=A4+A(X,3):NEXTX:GOSUB1700:REM TOTAL OF ORDER
1070 PRINTE1$:PRINT"TOTAL OF ORDER";TAB(20);USINGU$;A4
1075 PRINT:INPUT"DO YOU WANT TO MAKE A COMMENT ON THE ORDER FORM (Y/N)";R$:IFR$="Y"THENGOSUB2000
1077 IF R$="N" THEN R$=" "
1080 PRINT:INPUT"SHIPPING/INSURANCE CHARGE (F=FLAT RATE, P=% OF ORDER, N=NONE)";C2$
1090 REMSETS UP SHIPPING/HANDLING AND TAXES
1100 IFC2$="N"THEN1140
1110 IFC2$="F"THEN1120ELSE1130
```

More →

is the error correction routine. After all data has been initially entered, a summary of the order will be displayed. At this time the entries may be corrected, added to or left as they are for printing. There are three choices for the user—OK to indicate that all is correct, C to indicate that a change is needed or A to indicate that another entry is needed.

If C is entered, the line for correction is requested. After entering the line number, the question QUANTITY will appear. If the quantity is to be changed, enter the change; otherwise, press enter and the PART # question will appear. Again, if it is alright, enter a return or enter the correct information. All other line entries are similar—if it is OK, press return or enter corrected data.

If you wish to delete a line of data, again enter the line number. On each question, enter a space and then a return. The space will take the place of the deleted item and will not be printed on the printer, but will show on the CRT as zeroes for entries to show that a line has been deleted.

The program will accept 18 entries. This number is determined by the screen size and the way the data is entered. Line number 790 sets this limit for the CRT and line 1470 sets the page size for the printer (22 lines in this case).

The program lets you add up to 255 characters for comments to order forms. It is available from the author for $5. Include a formatted H-89 disk.■

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Program listing continued.

```
1120 PRINT:INPUT"FLAT RATE";C2:GOTO1140
1130 PRINT:INPUT"PERCENTAGE";C2:C2=C2*A4
1140 PRINT:INPUT"ENTER TAX RATE (.05=5%) IF APPLICABLE";A6
1150 A5=A4*A6:REM COMPUTES TAX
1160 REM
1170 PRINT E$+"z":REM SETS ALL PARAMETERS BACK TO NORMAL
1180 REM
1190 REM PRINT ROUTINE FOR PRINTER
1200 REM
1210 PRINTE1$:INPUT"IS THE PRINTER READY? PRESS RETURN WHEN READY.";W$
1215 IFW$<>"Y"THEN1210
1220 REM OPENS LINE PRINTER FILE
1230 OPEN "O",1,"LP:"
1240 PRINT#1,E$;CHR$(30)
1250 PRINT#1,TAB(50);"DATE ";Y4$
1260 PRINT#1,N1$
1270 PRINT#1,S1$
1280 PRINT#1,Z1$;:PRINT#1,TAB(90);"INVOICE # ";I$
1290 FORX=1TO5:PRINT#1,L$:NEXTX
1300 PRINT#1,"CHARGE TO   ";P7$;TAB(44);"SHIP TO  ";N$;TAB(90);"PHONE NO. ";PA$
1310 PRINT#1,TAB(12);P8$;TAB(53);S$
1320 PRINT#1,TAB(12);P9$;TAB(53);Z$
1330 PRINT#1,L$:PRINT#1,L$:FORX=1TO120:PRINT#1,"-";:NEXTX
1340 PRINT#1,L$
1350 PRINT#1,"SHIPPED";TAB(12);"QTY";TAB(25);"PART #";TAB(55);"DESCRIPTION";TAB(89);"U/C";TAB(101);"
E/C";TAB(110);"REMARKS"
1360 FORX=1TO120:PRINT#1,"-";:NEXTX
1370 PRINT#1,L$
1380 FORX=1TOCR
1390 IFA(X,1)=0 THEN 1460 :REM DON'T PRINT DELETED ITEM
1400 REM PRINTING DATA ON FORM
1410 PRINT#1,TAB(12);USINGU1$;A(X,1);
1420 PRINT#1,TAB(26);A$(X,1);TAB(56);A$(X,2);
1430 PRINT#1,TAB(85);USINGU2$;A(X,2);
1440 PRINT#1,TAB(98);USINGU$;A(X,3)
1450 H=H+1
1460 NEXTX
1470 A9=22-H
1475 PRINT#1,L$,L$:PRINT#1,R$
1480 FORX=1TOA9:PRINT#1,L$:NEXTX
1490 PRINT#1,L$:FORX=1TO120:PRINT#1,"-";:NEXTX
1500 PRINT#1,L$
1510 PRINT#1,"SHIP VIA ";M$;
1520 PRINT#1,TAB(90);"TOTAL";TAB(98);USINGU$;A4
1530 IFA5<>0 THENPRINT#1,TAB(90);"TAX";TAB(98);USINGU$;A5
1540 PRINT#1,"METHOD OF PAYMENT ";P$;
1550 PRINT#1,TAB(80);"SHIPPING/HANDLING";TAB(98);USINGU$;C2
1560 C3=A4+C2+A5    :REM C3=TOTAL OF ORDER, A4=AMOUNT OF ORDER, C2=SHIP/HAND, A5=TAX
1570 PRINT#1,TAB(80);"TOTAL OF ORDER";TAB(98);USINGU$;C3
1580 IFP$="CARD" THEN PRINT#1,P1$;" CARD # ";P2$:PRINT#1,"EXPIRATION DATE ";M2$
1590 PRINT#1,L$ :PRINT#1,"SIGNATURE................................"
1600 REM
1610 PRINT#1,CHR$(12):REM   TOP OF NEW PAGE
1620 CLOSE#1:A4=0
1630 REM
1640 INPUT"DO YOU WANT TO MAKE ANOTHER ORDER (Y/N) ";Q$:IFQ$="Y"THEN1650 ELSE 1660
1650 C2=0:A6=0:ERASE A:ERASEA$:GOTO330
1660 END
1670 REM
1680 REM SUMMARIZES ORDER FOR ACCURACY CHECK AND ERROR CORRECTION
1690 REM
1700 PRINTE1$:PRINT"HERE IS A SUMMARY OR YOUR ORDER. IF THEIR IS AN ERROR, CORRECT IT NOW."
1710 PRINT
1720 PRINT"LINE/NO","QTY","PRT/NO";TAB(50);"DESC";TAB(68);"UNIT PRICE"
1730 FORX=1TO80:PRINT"-";:NEXTX
1735 FORX=1TOCR:IFA(X,2)=0 THEN1745
1740 PRINTX,A(X,1),A$(X,1),A$(X,2);TAB(70);USINGU2$;A(X,2)
1745 NEXTX
1750 PRINT:PRINT"EXTENDED TOTAL OF ORDER $";USINGU$;A4
1760 PRINT:INPUT"OK=ALL ENTRIES CORRECT, C=MAKE CORRECTIONS, A=ADD ENTRIES";X1$
1770 PRINT:IFX1$="OK"THENGOTO1870
1780 IFX1$="C"THENPRINT"TO DELETE A LINE, ENTER '0' IN ALL FIELDS ELSE ENTER CORRECT DATA":GOTO1800
1790 IFX1$="A"THENCR=CR+1
1800 PRINT:INPUT"LINE NUMBER";X
1810 IFX1$="A" AND X<CR THENPRINT:PRINT"INCORRECT LINE # FOR ADDITION.NEXT LINE IS # ";CR:GOTO1800
1820 IFX>CR THEN PRINT"YOU DON'T HAVE THAT MANY LINES!":GOTO1800
1830 INPUT"QUANTITY ";A(X,1):INPUT"PART # ";A$(X,1):INPUT"DESCRIPTION ";A$(X,2):INPUT"UNIT COST ";A(
X,2)
1840 A(X,3)=A(X,1)*A(X,2)
1850 A4=0:FORX=1TOCR:A4=A4+A(X,3):NEXTX
1860 GOTO1700
1870 RETURN
2000 PRINTE1$:INPUT"ENTER YOUR COMMENTS--LIMIT 255 CHARACTERS.";R$
2010 RETURN
```

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Off to a cautious start, the U.S. must plan some bold moves to compete in the videotext market.

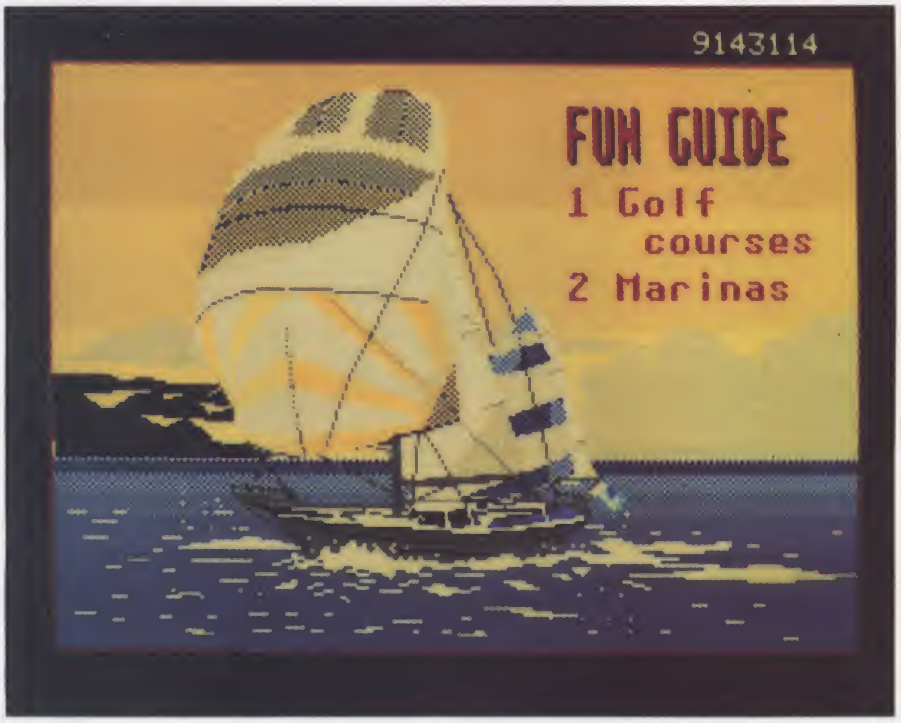
Around the World With Videotext

By Henry and Elizabeth Urrows

Much talent is at work developing computer-based communications systems that use television, the telephone or cable. Most of the inventions originated in England, France, Canada and Japan. We, in the U.S., cautiously adapt what is emerging elsewhere for our massive yet hard-to-predict markets.

We are now in an era of videotext concept trials and market tests, gingerly introducing what others began a decade ago. Our private enterprise economy inhibits risky, costly experiment. Countries which have government-financed enterprises and national post and telegraph authorities (PTTs) are bolder than our corporations, whose officers are afraid of letting their bottom lines sag.

Videotext studies are a fascinating small industry in themselves. The only *happenings* in their variegated terrain of pilots, models and trials are the one-way Ceefax and Oracle teletext systems in England, the British Telecom two-way Prestel viewdata system, Prestel International in eight countries and the Finnish commercial Telset in Helsinki. You can add the Dutch TVS in Amsterdam that began in 1980, and for perspective include the Dow Jones News/Retrieval Service, CompuServe and The Source. After these, all the rest are tests.



Telidon travel guide introduces two sets of pages. (See taxi photo on page 88.) (Courtesy of Infomart.)

Swiss Trial

One of the smallest two-way viewdata trials has been going on in Switzerland since November 1979. It began as a 16-port system, using Prestel software. An interesting feature of the system is its ability to use either German or French. After accessing the system, the user chooses which language will be used for that session. (All error messages are bilingual.)

Because of a shortage of terminals, the Swiss PTT began the trial with very few users. By March 1980 there were 70 business subscribers and 20 PTT departments using 32 ports. In July memory space increased from 4.8M bytes (4000 pages of information) to 70M bytes (60,000 pages). By March 1981 there were 86 subscribing organizations and 100 members of the Swiss Viewdata Information Providers Association (SVIPA) looking toward a test service in 1983 with 2000 subscribers.

The Swiss trial is pertinent to the U.S. because it addressed the question of whether the PTT should limit its role to *transport* of information

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(i.e., service as a common carrier) or also offer storage capacity to information providers. (As long as the Bell System's functions are being defined by the U.S. Congress, the Federal Communications Commission and the courts, it is hard to tell whether AT&T will be only a manufacturer of Western Electric videotext terminals, a network, a publisher of electronic yellow pages or some combination of these.) The SVIPA strongly opposes the PTT offering even limited storage space to information providers, especially to small ones who cannot afford their own external databases and do not want to depend on private umbrella information providers. SVIPA is afraid the PTT would sell storage at lower prices than private database owners.

Standard Telephone and Radio AG (STR) technical director Peter A. Gfeller and data systems manager Pierre E. Schmid have written that "one point of particular sensitivity and interest" is how Canada's advanced Telidon alphageometric graphics "could be introduced in the alphamosaic European world." STR proposed that every terminal have minimal alphamosaic capability. The videotext center is to be transparent for all other formats. They foresee multiple-mode terminals that will be able to switch between alphamosaic and alphageometric modes. Such a terminal should resemble those implicit in the AT&T Presentation Level Protocol standard (see "Setting the Standards for the Industry," *Microcomputing*, Oct. 1981, page 77).

Switzerland's July 1980 specifications for the trial envisioned:

- three transparent videotext centers interconnected via the Swiss data network TELEPAC
- information retrieval through the Public Switched Telephone Network (PSTN) and the videotext center
- information input directly to databases either through PSTN or TELEPAC
- data collection provisions
- a message service
- closed user groups
- three languages
- separate subscriber modems
- and a *gateway* function to external databases.

Gateway and Bildschirmtext

The Deutsche Bundespost has said it will introduce its Bildschirmtext viewdata service across West Germany in 1983. Duesseldorf and Berlin field trials have been in progress with 6000 terminals since June 1980. The genius of Bildschirmtext (Btx) is that, using enhanced Prestel hardware and software, videotext centers serve as a network giving users access to third-party host-computer databases. Banks, publishers, stores, travel firms, etc., can use their computers via Btx to facilitate electronic funds transfer, for remote ordering of goods and services and for real-time updating of databases.

> The benefit of viewdata has not been to save money or time for Whitbread, but to overcome the resistance which many people in industry seem to have to the use of computers.

Heinzfred Mantel, data communications systems development chief of Standard Electrik Lorenz AG (SEL), has described a Seltext center designed to serve approximately 80,000 subscribers. It stores 100,000 frames of information in its basic configuration and can be enlarged to store up to 2 million pages. Gateway service subscribers and information providers communicate with the center by public telephone and the network of videotext centers.

In sales parlance, Gateway is hot. British Telecom has licensed it from the Bundespost and promises to offer Gateway service on Prestel while its Canadian competitors say they can in time deliver Gateway with Telidon. At the Videotext '81 conference at Toronto last May, Alan R. Haimes, information systems divisional manager of Systems Designers Ltd. in Surrey, explained how Gateway enables private viewdata systems to seize advantage of both public and private services.

Private viewdata systems that do not furnish their own networks and that have numerous remote locations incur large telephone toll charges. With Gateway, however, a private viewdata system can use a public service for local-call access to a local viewdata center.

"This arrangement," according to Haimes, "leaves the third party (i.e., private) database operator free to provide any of the services his company requires or indeed that the marketplace will buy."

The Gateway facility eliminates the practical problems of large remote data-storage costs, slowed response times, and unfriendly preliminaries required to establish network user identity, password and network address of the host computer. By simply selecting the Gateway page of an external computer, the terminal user connects with it.

West German organizations seeking to make Gateway connections over the last two years have been forced, Haimes said, to develop their own software. Others now have the benefit of their pioneering. This can make Gateway service cheaper, faster and more reliable.

Prestel, Ceefax, Oracle

Richard Hooper, director of Prestel for British Telecom, says that there will be full Gateway service on Prestel in early 1982. And that 120 organizations are queued up to use it.

In Britain 14 private viewdata systems are in operation. TOPIC (Teletext Output of Price Information by Computer), operated by the London Stock Exchange since June 1980, can connect 1000 terminals to each Modcomp Classic 7870 computer without exceeding the maximum tolerated response time of one second, and can handle a peak of 200 page-requests per second on each machine. Orders will bring the total number of terminals to 1300 by April 1982. Designed for flexibility, TOPIC can serve closed user groups, connect to remote country locations by public networks, use Gateway to view client portfolio data and to access Ceefax, Oracle and Prestel.

One private system unlikely ever to want Gateway is Whitbread breweries' DAISY (Daily Information System), which consolidates data on customers' orders coming from five regional computers into easy-to-read-at-a-glance colored graphic production charts. The benefit of viewdata has not been to save money or time for Whitbread, but to overcome the resistance which many people in industry seem to have to the use of computers, Sam Fedida and Rex Malik have written.

Among Prestel enhancements are high-resolution graphics, single color dynamic redefinable character sets (DRCS) succeeded by multicolor, multilanguage text, smoothline graphics, ranges of pastel colors and color borders, data encryption for users' security and the new PANDA (Prestel Advanced Network and Database Architecture) network. This means Gateway with messages and access to third party databases, tailored insurance quotations and mortgage calculations, real-time service on airline and hotel reservations, high volume data capture for transactions such as mail orders, very large specialized scientific and bibliographic databases, printers and associated equipment. There is also Picture Prestel, demonstrated at Viewdata '80 by DPCM (Differential Pulse Code Modulation) but due to be introduced in London as the first phase of an integrated services digital network.

Prestel can be useful when it lets users
avoid lines at banks and travel agencies
when ordering checks, booking airline space,
getting theater and train seats
and finding updated information
quickly and conveniently.

Britain's Ceefax and Oracle teletext systems have earned sufficient user acceptance to assure their continuation. Ceefax is paid for by the license fee every TV set owner or renter must pay according to British law. Ceefax has taken less than $1 million in capital investment and no more than $500,000 in annual operating costs. The IBA is a profitable commercial TV enterprise that makes enough profit to afford Oracle as a public service. Because teletext can also be an advertising medium, what public service CBS, NBC and Westinghouse contribute will be incidental to their profit-making functions.

The British Post Office has already invested more than $48 million in Prestel. Equipment and microchip manufacturers had put in an estimated $24 million, and over 200 information providers at least $7.2 million.

British Telecom, split off from the Post Office by an act of Parliament, is not yet making money from Prestel. The worst depression in England since the 1930s is a central factor, and may well explain why seven out of eight subscribers are business users able to charge their decoders and fees as company expenses. The assumption that entrepreneurs in the U.S. are making is that videotext is a mass residential market along with broadcast and cable TV.

Prestel can be useful when it lets users avoid lines at banks and travel agencies when ordering travelers checks, booking airline space, getting theater and train seats and finding updated information quickly and conveniently. Too many persons in service occupations there (and in the U.S., too) hate their jobs. Some bureaucrats in government, business, and institutions waste time telling you at length why they can't help you. For consumers who would just as soon have competent comparison shopping done for them, who seek apartments or job openings that are too often taken before newspapers advertising them hit the street, for executive searchers hunting exactly the right candidate with minimum rigmarole—viewdata can work.

Antiope

CBS petitioned the FCC on July 29, 1980 to adopt a teletext standard

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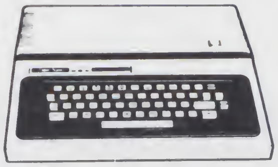
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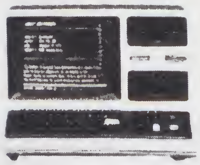
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based on the French Antiope (Acquisition Numerique et Televisualisation d'Images Organisees en Pages d'Ecriture) system. Antiope has a variable or asynchronous format, unlike the British Ceefax, Oracle and Prestel, which have a synchronous or fixed format. In the British system the position of data on the TV scanning line directly relates to the position of the display on the TV screen. With Antiope, there is no relationship between the data on the TV scanning line and its location on the screen.

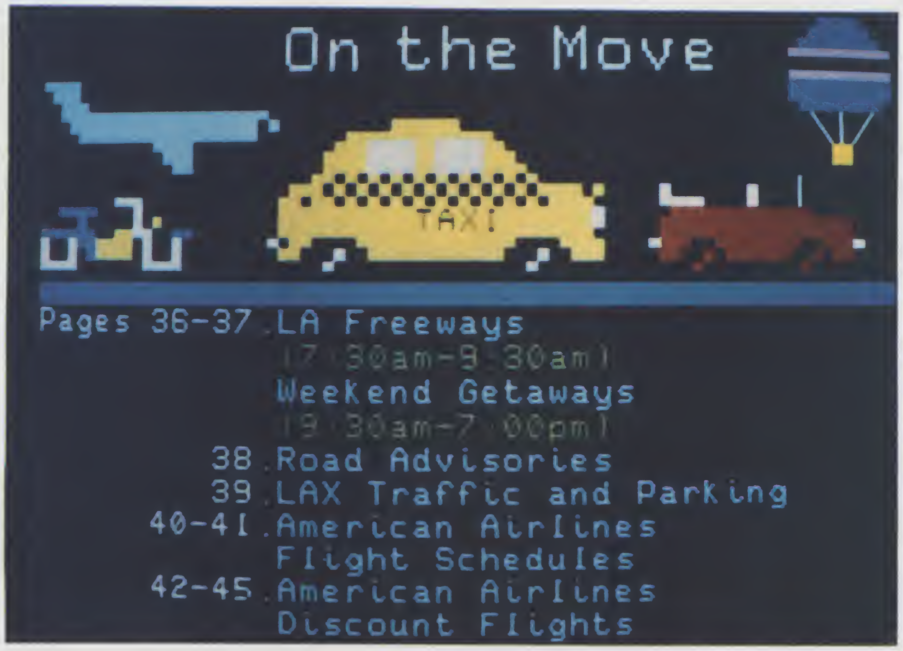
CBS's supporting engineering statement said each of the two systems has advantages and disadvantages, based on fixed format tests made at KMOX-TV St. Louis and variable format transmissions over KNXT-TV Los Angeles. CBS technical people chose the latter in the belief the variable format can more easily adapt to changing technology.

France's one broadcasting company, Telediffusion de France (TDF), has broadcast a stock teletext service in partnership with the French Stock Exchange Committee since 1977 and an experimental teletext weather report since 1979, and installed terminals at two companies' gasoline stations for weather and traffic reports in the summer of 1980. The French PTT installed the first 50 electronic telephone directory terminals at Saint Malo in July 1980. By the end of May 1981, 1500 users were to have been given free videotext terminals in Ile et Vilaine in western France to access 270,000 entries of regional white and yellow pages.

If this second pretrial works as planned, a full 270,000-terminal trial is scheduled to begin at the start of 1982, looking toward a national electronic telephone directory serving 30 million customers by 1992. The French PTT believes it will cost less to give away terminals on that scale than to continue printing telephone books, which now cost about $230 million a year.

Looking toward national acceptance of Teletel, the two-way viewdata system based on Antiope, nearly 170 business and government organizations have contracted to furnish database material for a trial in Velizy, southwest of Paris, where the first 20 terminals were placed in April and 2500 residences—2100 equipped with Teletel adapters to color TV sets and 400 with black-and-white terminals—are to be connected by September 1981. Starting in June, 300 users were to have been supplied with smart cards—plastic cards embedded with microcomputers which can be used for up to 100 home and point-of-sale financial transactions—and smart card readers interfaced with Teletel terminals.

According to Intelmatique, Teletel has Gateway, permitting users instant access to third-party databases throughout France. And Lee R. Greenhouse of the Link Resources market research firm wrote in the February 1981 issue of *Data Communications* that with the Teletel network France's approach differs from other countries "in that its public network handles all switching and network management, but not database control. . . . Teletel will have no central computer, as have both the British and the West German implementations. Instead, the network it-

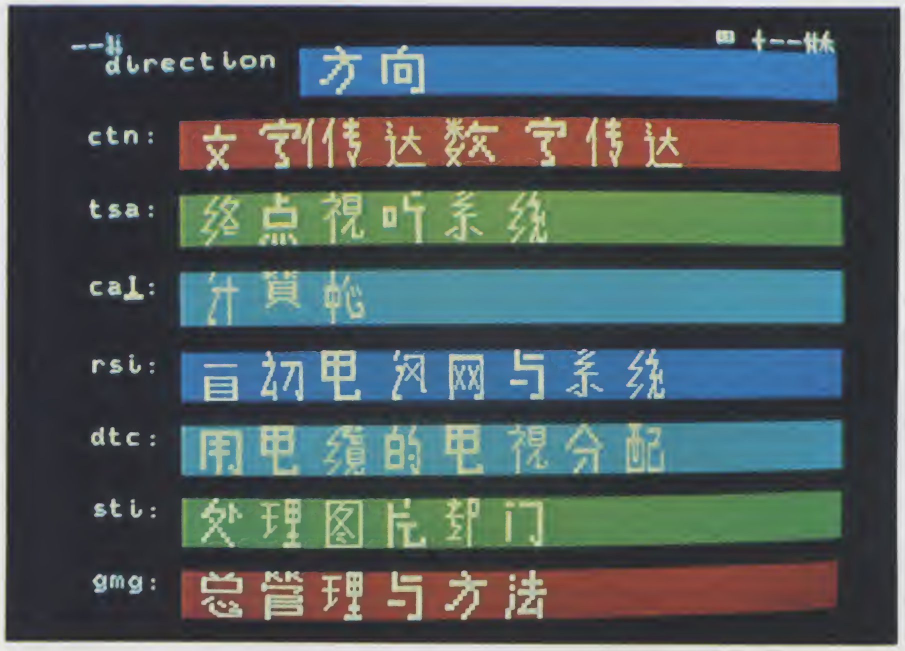


On the Move

TAXI

Pages 36-37 LA Freeways
(7:30am-9:30am)
Weekend Getaways
(9:30am-7:00pm)
38 Road Advisories
39 LAX Traffic and Parking
40-41 American Airlines
Flight Schedules
42-45 American Airlines
Discount Flights

"On the move" from the Telidon travel guide.



direction 方向
ctn: 文字传达数字传达
tsa: 终点視听系统
cal: 计算机
rsi: 自动电讯网与系统
dtc: 用电缆的电視分配
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Oriental language characters have presented unique problems, but these, from Antiope Videotex Systems, can be downloaded using DRCS (dynamically redefinable character sets).

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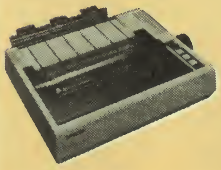

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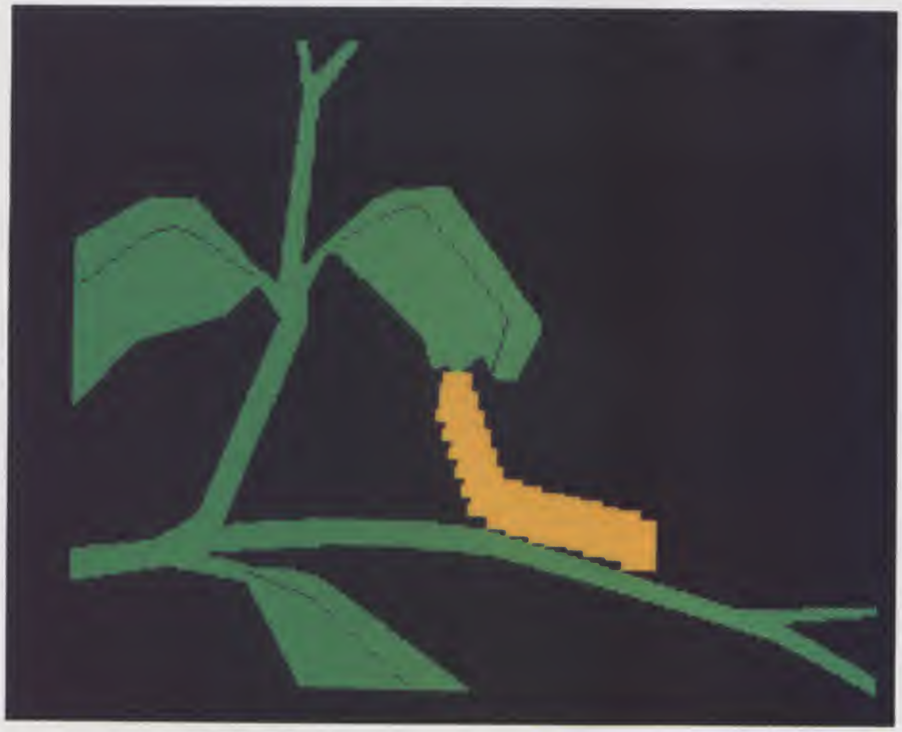


Animated Telidon sequence that shows a caterpillar eating a leaf and turning into the butterfly. (Andrej Teene-Sens, informatics technical adviser to the Canadian federal Department of Communications, believes these kinds of animation are possible only in alphageometric teletext and viewdata systems.)

self will do all switching, connecting users with the appropriate hosts, which are maintained by the information providers and contain the interface software."

France plans to invest $27 billion during the next five years to become the "Charlemagne of the wired nations" and a major source of communications technology, having set an initial objective of exporting 30 percent of its telecommunications equipment by 1982. France has thus far been bolder than Britain in selling. To help bring the cost of terminals down, the French PTT itself ordered 300,000 from four manufacturers in May 1981, and Tymshare of Cupertino, California has ordered 100,000 personal computer terminals from the French manufacturer Matra. TDF has loaned Antiope teletext equipment—page generation, captioning gear and the patented Didon transmission system—that cost more than $1 million for the Los Angeles trial by CBS of its Extravision teletext over the CBS TV station KNXT and by PBS station KCET of its teletext magazine NOW. On-air service began in April 1981 to less than a score of terminals in public places, looking toward 100 more decoders being in homes by end of summer. French promoters are unafraid to prime their pumping of U.S. markets with competitive selling zest.

Antiope Videotex Systems, Inc. sent Claude Sechet to speak at IEEE in Chicago in June 1980 on Antiope teletext captioning. The Didon system is transparent in accepting any kind of digital signal without altering it in any way. Sechet said the Antiope variable asynchronous format permits placing the caption anywhere on the screen, using the same decoder for captions and teletext and DRCS for symbols. Prototypes were testing the validity of these services when he gave his paper.

General Manager Marcel Berger of Sofratev and chief engineer Y. Noirel of TDF's CCETT data broadcast procedures lab described DIODE (Diffusion d'Information Obtenu par Demande), the data retrieval system that uses entire TV channels to transmit nothing but data, at Toronto in May 1981. They said six magazines with about 600 pages using about 60 lines per field were being broadcast over a specialized network employing only one-fifth of one channel's capacity. Sofratev and CCETT plan to put into operation a 20-channel videodata multiplexer this year. They are also studying a three-channel videodata multiplexer that will be fully microcomputer-programmed to assign each field the number of lines needed for transmission of the data present in the buffers assigned to each digital channel. They call this dynamic allocation and say that "to make the best use of the possibilities offered by the asynchronous system will certainly take a while to finalize." DIODE combines a high data rate and wide coverage. It points a way to solve the problem of congested interactive networks.

Telidon

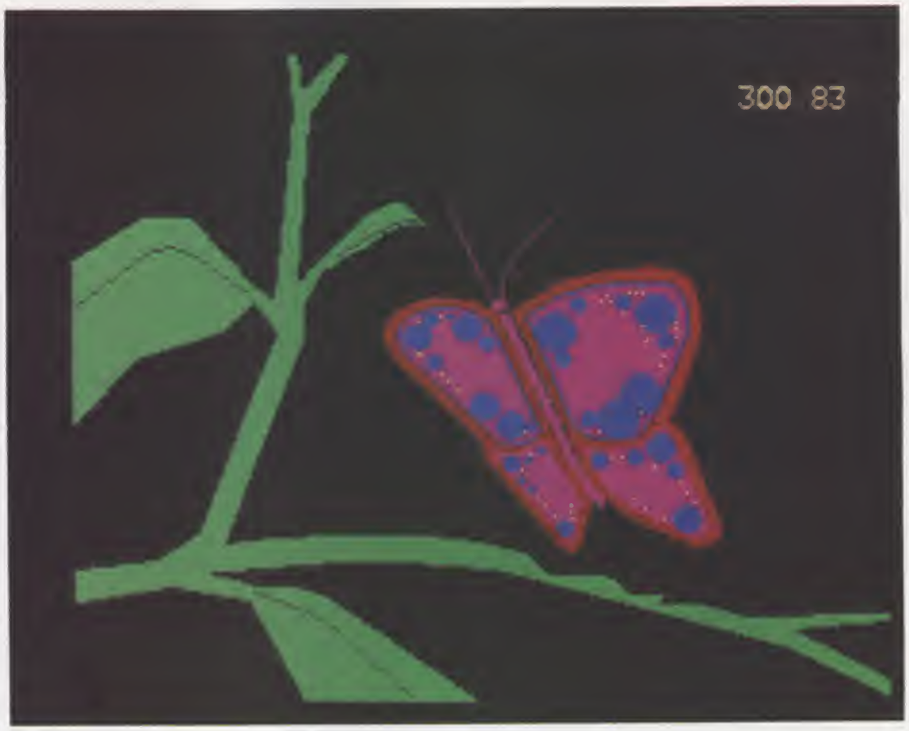
Canada's videotext salesmanship has such a high energy level and is so vigorously resourceful that it isn't easy to separate achievements from dazzling future plans.

Four pilot operations in as many provinces have transmitted and decoded many thousands of frames by satellite, on-air broadcasts, phone wires and dedicated cable pairs to at least 125 terminals. Four more trials with government money, and three using corporate and utility capital, have begun or are scheduled. Canada began a four-year encouragement program committing $10 million in 1979. This was increased by $27.5 million in 1981, when Bell Canada said it will invest $8.5 million in trials being held in Toronto and Quebec City.

Telidon was demonstrated at Information Utilities '81, held in New York this April. The graphics were beautiful, even though the salesmen at the exhibit tended to use selective truths that didn't withstand careful scrutiny.

We were captivated, though, by the best organized and most incisive oral presentation of videotext we had ever heard, given by Larry Pfister, sales vice-president for the Telidon Videotex Systems, Inc. for Infomart, the Canadian electronic publisher and vendor of turnkey systems.

Pfister was low-key, yet exuded strong confidence when he reported that Time, Inc. will use Telidon for its late 1981 teletext test on one of the cable systems owned by its American Television & Communications Corporation (ATC) subsidiary, and that the Times Mirror has said it will buy a 200-terminal field trial setup operating simultaneously over telephone and two-way cable networks in Los Angeles and Orange counties in California, also in late 1981.



The butterfly from the animated Telidon sequence.

Canada is jumping with trials and announcements of more to come. Since January 1980 the Ontario Educational Communications Authority has sent teletext pages to 55 terminals, some of them in a remote northern town reached by the ANIK-B satellite.

Since May 1980 the Manitoba Telephone System has connected 100 homes in South Headingley with coaxial cable (providing residents with digital telephone, answering and message service, telemonitoring for fire alarms, etc.) of which 30 are trying out Telidon terminals.

In late April 1981 the New Brunswick Telephone Company began rotating 45 Telidon terminals among 75 homes, businesses, and such institutions as the community college, public library and the University of New Brunswick's local campus in Saint John.

On May 20 Bell Canada kicked off its Telidon trial in Toronto and Quebec City, initially with 491 terminals, rationing half to homes, one-fourth to businesses, 15 percent to public places and 10 percent to educational users. Dubbed VISTA, it is not charging users or information providers.

In early May the Manitoba Telephone Co. installed 25 Telidon terminals in offices of grain elevator operators, crop-insurance agents, agriculture agents and places where farmers gather to do business in the southern part of the province. Two dozen information providers pay a dollar per page per month to furnish data on market prices, feed costs, grain futures and other variables that affect agribusiness. This Project Grassroots network will expand in the fall with some of the 150 terminals planned for the Elie-St. Eustache area testing Telidon transmission over optical fiber and there's expectation of expansion to break even—providing terminals and service at less than $60 per month before the end of 1982.

The Alberta Government Telephone utility is not forthcoming about just when its mid-1981 test network begins. Instead of using 120 terminals as planned, it's reported to be "bicycling" 30 sets among 120 locations.

British Columbia Telephone Co.'s videotext project market research supervisor says its 125 receivers will cost about $3000 each and should be in use this coming September and October in a trial budgeted at $3 million.

Projecting future terminal prices is something of an arcane art. Roger Woolfe of Butler, Cox & Partners, the

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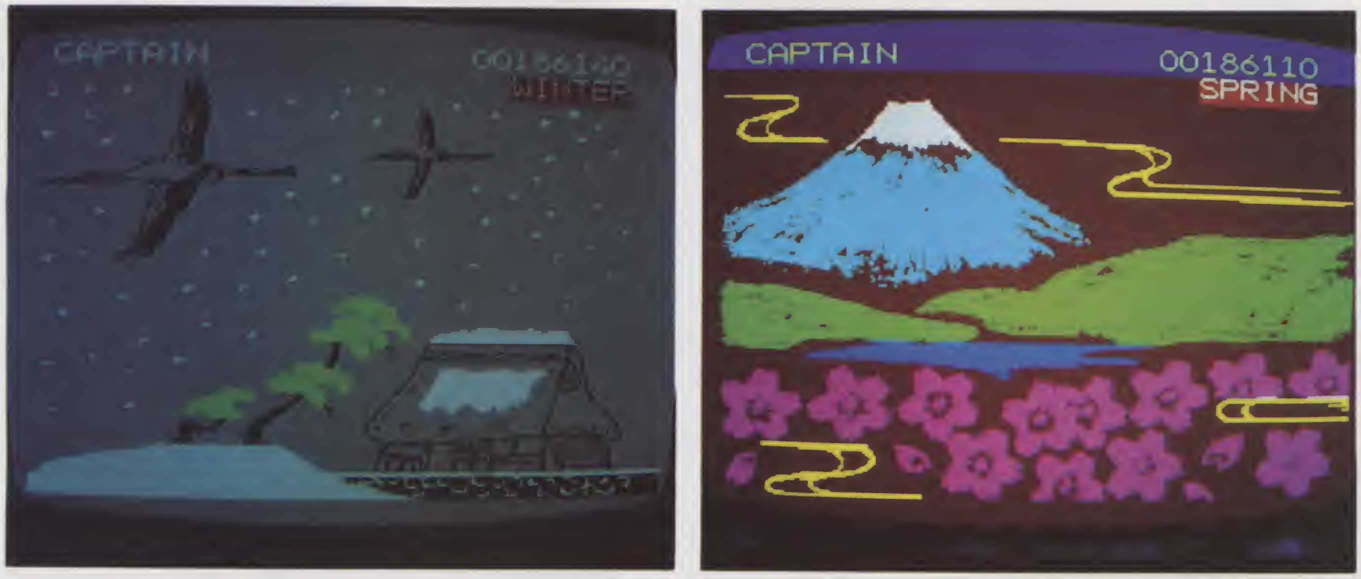


The four photos on these two pages represent the four seasons sequence in the CAPTAIN

British consulting firm, made a study in 1980. He found that Telidon decoders with TV monitors cost $1450 in Canadian dollars, compared with Prestel decoders at $1120. When production quantities reach 100,000 a year, Woolfe said the Telidon units should drop to $290.

Electrohome, one of four Canadian terminal makers, thinks it will produce over 1000 business terminals with color TV monitors in 1981 at $3876. When sales pass 50,000 a year in 1983, Electrohome says it "will be manufacturing a complete home consumer package with monitor, standard television capability, modem, teletext receiver, decoder and possibly keyboard capability, for $1100."

In the offing are a 150-terminal network of Canadian federal government departments connected by the DATAPAK network; 250 terminals tied into the Montreal Telecable Videotron test in early 1982; a two-city Cablecom of Saskatchewan "trial for later in 1981"; a Maritime Telephone & Telegraph Co. field trial in Nova Scotia in 1982; and the Canadian Broadcasting Corp.'s nationwide Telidon trial service forecast for the summer of 1982, at a projected cost of $6 million.

At the heart of Telidon are picture description instructions (PDIs) that encode and store basic geometric building blocks—point, line, rectangle, arc and polygon (polygons can have a maximum of 200 sides in present software)—with a range of options as to their location on the TV screen, size, color, luminance and other attributes. As the Department of Communications' assistant deputy minister for research, Douglas Parkhill, phrased it at the Inside Videotex seminar in March 1980: "All we do is to store in the database coordinates of the end points of the line and the computer instruction that says, 'Draw the shortest line between these two points'. . . . The storage capacity (versus the older method) is enormously reduced. It would take several hundred characters to store the line as mosaics. . . . In our system, it takes only five or six characters. So the secret of Telidon is . . . that any known picture can be represented by a finite number, and in fact a very small number of what we call 'picture primitives' or 'picture description instructions.' "

There are two assumptions behind anticipations that Telidon will be economically feasible. First is the expectation that the component cost will go steadily down. Second is that the costs of the users' decoders will be covered by capital from advertising.

Telidon must enhance its decoders to suit more advanced computer graphics in the AT&T videotex standard. After it does so, there may be a fresh irony when these, too, prove obsolete in the light of Japanese improved alphaphotographic videotext coding.

CAPTAIN

We wish we could see more of the CAPTAIN (Character and Pattern Telephone Access Information Network) system as it unfolds during premarket and market trials into full commercial service in 1983.

Although DRCS can reproduce all manner of symbols in enhanced editing and decoding terminals in the West, Japan started with 4000 different text characters—alphanumeric and special symbols.

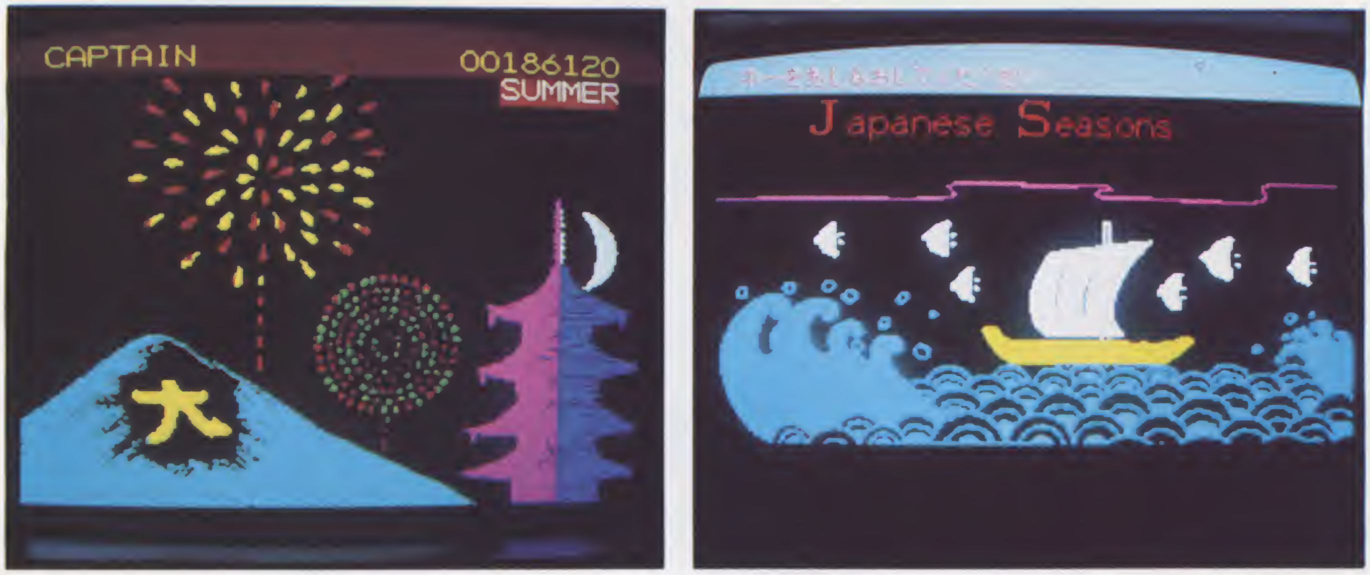
There are four kinds of input terminals:

- tablet
- keyboard
- those capable of directly reading hand drawn figures and photos
- those using a TV camera.

The displays give the viewer the impression that his or her wishes are respected with deference. Continuous delivery of a specified number of pages without requiring successive pushing of buttons will produce an entire sequence on a particular topic. These can be disclosed line-by-line from top to bottom, character-by-character from left to right, or by the familiar upward scrolling. The user can choose high or low scrolling speeds.

When the viewer orders merchandise, after reviewing the merchandise code number, size, color and quantity, he then signals whether these were correctly recorded, or if all were incorrect or some were incorrect. Cancellations are accepted within seven days of the order date.

Possibly the most agreeable quality of CAPTAIN is a kind of grace behind the composed pages, in the respectful imparting of desired facts and figures, the stories and games. The graphics have a stylized charm abet-



videotext format. (Photos courtesy of Nippon Telegraph & Telephone Public Corporation.)

ted by pastel hues and playful animation.

Conclusion

Now that AT&T and Western Electric seem to be coming aboard, even though they won't bring out a decoding terminal that meets their new standard until May 1982 at the earliest, consensus is that teletext and viewdata may yet get to be big business. Let's not hold our breath. But we can bet that small, imaginative electronic publishers—such as those making video games and software for micros—will have more and larger markets. As with the early years of autos and radio there may well be high birth and death rates for companies.

Some quotient of software programs on videotext, though, should be well worth our time. At their least they'll be convenient. At their best they may bring new kinds of enjoyment.■

PLAIN TALK ABOUT "COPY PROTECTION"

A lot has been said and written about copy protection and software piracy since Omega made Locksmith available to Apple II users earlier this year. We have been accused of encouraging illegal copying of copyrighted software. Software publishers have threatened to boycott magazines which carry our advertising, and the pros and cons of Locksmith and copy protection devices have been debated in Apple forums throughout the country. But, we at Omega haven't really told you, the Apple user, our side of the story.

Locksmith was originally developed as an intellectual exercise by an Apple user over a year ago. And we suspect that sufficient information about the Apple DOS and the way information is stored on a disk has been long available to the general public, so that ANYONE who was REALLY interested, and who wished to spend a LOT of time, could have written a program that does many of the things that Locksmith does. Similarly, there is really no "secret" to writing data base programs, adventure programs, or even spread sheet programs. The literature is there if you want to look for it. But it takes a lot of hard work to develop any software package that works in all cases, that is crashproof, that interfaces easily with a non-experienced computer user, and that is well documented. A LOT of hard work.

But even before Locksmith was available to us, we, as Apple users, recognized a definite problem with the software we were buying and using. Much of it worked well. But it was very aggravating to not be able to make a backup copy of certain "copy protected" programs. Most software pubishers didn't supply backups of their programs, and those that had any policy required signing opressive agreements or paying questionably high yearly fees for presumed, but not guaranteed, updates. Among those who did not offer back-up was one who 'sold' us a new copy (when we returned our crashed disk). Although they advertised the importance of having their program running every day, they made us wait up to 6 weeks to get the replacement. Most vendors just ignored the problem. We, as consumers, were simply taken advantage of. In many cases we relied so much on a particular program, that it became very costly to have to wait weeks or more to replace a blown disk. Software publishers were just not responsive to the users problems caused by "copy protection".

When we first became aware of Locksmith, we investigated the state of the law, and discovered that no one knew whether the owner of a program could copy it for backup. And for quite a while we debated whether we should market Locksmith.

On December 12, 1980, a change was made to the Copyright Act which resolved these questions. It is now the law of the United States that the existence of a copyright notice on a computer program does NOT make it illegal for the legitimate owner of that program to copy it for archival purposes. Backups are now clearly legal. (Of course, when you sell your purchased program, you must destroy the backups you have made). Only after such use clearly became legal did we decide to sell Locksmith.

Now with the new copyright law, which for the first time gave software publishers clear rights that were enforceable in court, but which also gave "backup" rights to software purchasers, and with the demonstration that Locksmith could and would provide back-up for the user, we assumed that software publishers would drop their copy protection schemes and educate the public as to their rights and responsibilities. Even the use of hardware protection that gives copy-ability to the software would be acceptable. Unfortunately, their response has been to pressure magazine publishers into refusing our advertising, and to invent new copy protection schemes.

Well, the word about Locksmith was impossible to stop. We couldn't advertise, but we have sold a gratifyingly large number of programs. As to new copy protection schemes, the new Locksmith (version 4.0) will adjust to them, and copy virtually anything protected that way. But please. For us, for yourselves, and for the entire industry, use Locksmith only for its intended legal purposes.

The new version is more than just the best copy program available. There are also four additional utilities included. A disk speed program, a degauasser, a nibble editor and a media surface analyzer are included. And we stand behind our products. Our customer service department is available (and anxious) to help with problems.

Locksmith 4.0 is available from us, or your local dealer. Visa and Mastercard users call Toll Free 1-800-835-2246. Kansas residents call 1-800-362-2421 or send $99.95. (Registered owners of prior versions can obtain an update for only $20. If you haven't received a letter from us, please call.)

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For the computer owner on the go, this portable terminal can provide color display capability for any computer with an RS-232-C port.

RCA's "Connection To the Computer World"

By Frank J. Derfler

Microcomputers may be versatile, but they can't be all things at once. If you enjoy using data communications systems, you may frequently find that your 32K dual-disk system is busy killing Klingons just when you want to check your electronic mailbox. You might want a quick stock market report, but it seems a shame to dump the program you are debugging just so you can get on-line.

What you need is a terminal to use just for data communications. While you are at it, how about one that is small, portable and rugged, costs less than half of what you would expect to pay for a standard video terminal, and can provide a color, graphics and sound display from any computer? How about one made by a leading U.S. manufacturer? Meet the RCA VP3303 color data terminal.

What It Is

This device is everything a complete terminal should be, minus the display. The display can be any available television set (color or black-and-white) or monitor. The terminal is small enough to fit into a briefcase with lots of room to spare. It is light and rugged enough to go anywhere and survive nearly any treatment. It provides an extensive keyboard and many special features such as reverse video, variable colors and variable pitch and tone sound. It provides either a current loop or RS-232C interface for a modem (not supplied). The entire unit retails for $389.

What's Inside

The heart of the RCA 3303 is an RCA 1802 CPU. It resides inside a tough low-profile case, along with 1K of RAM for the screen, 1K × 4 of color RAM and an extensive character set in ROM. You can do a little local programming of the 3303, changing the way some characters are displayed and the print and background colors of the display screen, but essentially the RCA 3303 is a dedicated terminal device with a color display.

The keyboard surface of the VP3303 is unique. It is a tough membrane of flexible polycarbonate which eliminates the mechanical problems associated with other keyboard systems. It is easy to clean, moisture resistant and perfect for tough environments. If you have ever spilled even a few drops of coffee into a conventional keyboard, you know the trouble it can produce. The VP3303's housing is not waterproof, but a little carelessness won't cost you a new keyboard encoder.

The 58 keys can generate a full 128-character ASCII set. It certainly is nice to see the full keyboard capability with all of those brackets, lowercase characters, control codes and other symbols that can be so handy. Few microcomputers have such complete keyboards.

The television set (or a separate audio output if you are using a monitor) provides a tone each time a key is pressed, which gives the positive feedback missing in the touch.

Even after I used the VP3303, I had reservations about how the flat-faced keyboard would be accepted, so I took it to a local manufacturing company whose accounting staff spends a large portion of every day keying in payroll, accounting and personnel data. We replaced one of their on-line terminals with the VP3303 and a portable color TV set. The VP3303 is limited in display size by the bandwidth of the TV set, so it could only display 24 lines of 40 characters, but that was sufficient for many input functions.

The office workers got the feel of the keyboard after about 60 seconds on-line. They found their speed was slowed at first, but it improved to near normal after a few minutes. They praised the fact that they could move the keyboard around and even put it on their lap to type in a relaxed position.

The beep tone associated with each

Frank J. Derfler (PO Box 691, Herndon, VA 22070) is the author of the monthly Dial-up Directory column in Microcomputing.

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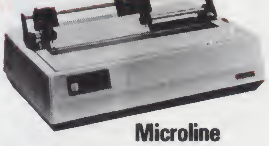
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Microline 82A

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The RCA VP3300 terminals are rugged devices which provide a unique range of capabilities including color graphics display and sound. They can be connected to nearly any computer as a color display device.

keystroke seemed to provide quite adequate feedback, although some of them found the change in tone when shifting to an uppercase letter to be a distraction rather than a help.

Interestingly, almost no one agreed on what color combination of letters and background was the most pleasing, but they all had definite favorites. Several liked black letters on a white screen. Not one person liked the white on green that researchers in the field recommend so highly.

This test application was more rigorous than the use RCA designed the VP3303 for. RCA advertises the VP3303 as "your connection to the computer world." They are obviously targeting it for home and light office use with information utilities, but the test proves that the keyboard is easily accepted by people who use data terminals in their daily work.

Sound and Lights

The color and musical abilities of the VP3303 can be put to use in several different ways. First, when you use it as a standard data communications terminal, you can arrange your screen the way you want to see it (e.g., blue on yellow). If you want to redefine any or all characters (perhaps to make all lowercase appear as uppercase, etc.), you can do that too.

Second, you can write programs in the host system which can address and move the cursor of the VP3303 all around the screen to draw figures and make the screen change colors and the terminal play music. The host system can be any computer with an RS-232C port. That means the VP3303 can act as a color graphics output device for a system like the TRS-80 Models I, II or III.

The graphics of the VP3303 can be very good. In the high-resolution mode you get 40 characters on 24 lines (low resolution is 20 × 12). Each character location is formed by a 6 × 8 matrix array of pixel dots.

Each ASCII character can be redefined to be any shape or combination of dots within the matrix. As an example, an apostrophe ('), or any other character, can be redefined to be an open square or any other useful shape. The host computer can then draw on the VP3303's screen by redefining characters as needed and sending strings of the right characters in the right places.

Text and graphics are easily mixed on the screen and pictures are painted with colored bits and pieces as the cursor moves around. This method of sending graphics via a slow-speed ASCII channel requires some tedious and repetitive programming, but it works well. A text editing program which holds often-repeated statements would be useful in writing the software needed to get the most out of the VP3303 system.

Use with the TRS-80

If you use a smart printer like the Epson MX-80 with your computer, you already understand how the VP3303 can be used as a color output device. First, the smart peripheral has to be jolted into paying attention by the receipt of two ESCAPE codes. The command ESC ESC B followed by a number changes the background color on the screen of the TV or monitor attached to the VP3303. That sequence is easy to send from BASIC by entering:

```
LPRINT CHR$(27);: REM 27 is the ASCII code
for ESC
LPRINT CHR$(27);: REM another one
LPRINT "B 5";: REM 5 is the number for yel-
low
```

All of these commands could be nested together on one line. Don't be confused by the fact that the LPRINT command normally sends the characters out the parallel port instead of the serial. On a system like the TRS-80 Model III, you can simply do a ROUTE command to route the printer output to the serial port.

A Model I program would have to call an appropriate driver routine for the serial port. The VP3303 is wired as data terminal equipment (DTE), which means it wants to receive data on pin 3 of the DB-25 connector. You may have to arrange the connecting cable to transpose pins 2 and 3 if your computer is also wired DTE.

This little program would be ex-

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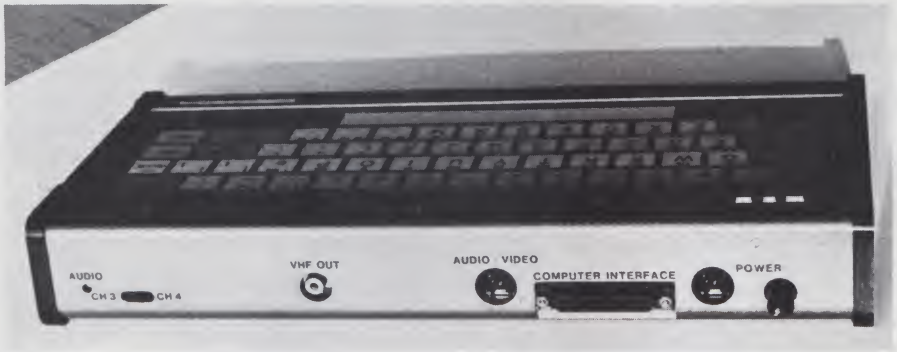


The rear panel of the VP3303 contains all the connectors and a few switches.

tended to send a graph or picture to the VP3303's screen. Similar LPRINT commands could be used to redefine how the terminal displays ASCII characters, moves the cursor, sends strings of characters and activates the music function.

On the TRS-80, the program would be written from the standard keyboard and the terminal would be used only as a display device. If the program is being written on an information utility or large computer system, the VP3303 can be used to write the program and display it. Various commands which will return the desired ASCII characters from remote systems are available.

Color on the Utilities

CompuServe and The Source are both close to offering color graphics service to their customers. CompuServe has a demonstration program on display at computer shows. It draws a weather map and other useful diagrams on the screen of a color terminal.

People at The Source have been talking about the same kind of service, but there is no firm word about the format to be used. The CompuServe color graphics format will not work with the VP3303. (You can write your own programs on CompuServe and they will play very well, but the utility's prepackaged pictures will not be displayed.)

The Source apparently will not use the CompuServe format, but it isn't clear what they will use. The industry still needs to sort itself out in the area of format, but for now the RCA VP3303 provides a fine way to display color graphics on big and small computers that think they are only spouting strings of ASCII characters.

Nitpicks

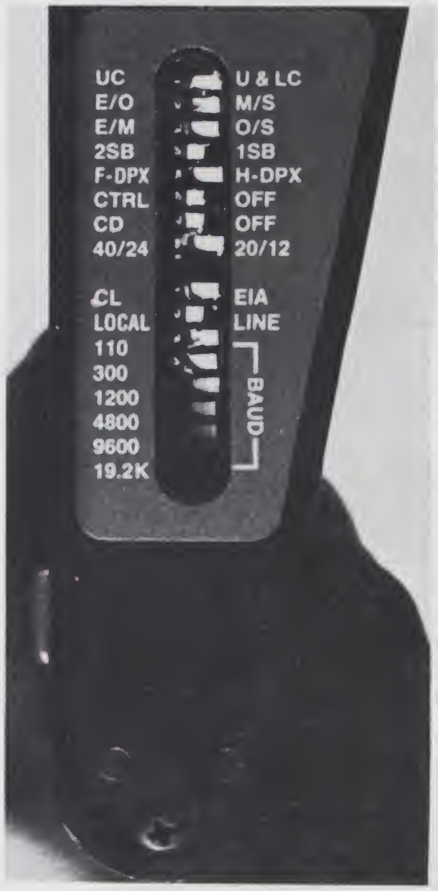
You can't have a fair review without a nitpick or two. The RCA VP3303 is a flexible, good-looking and rugged terminal device available at a reasonable price. But if you are going to use it actively (changing colors, etc.), you have to frequently manipulate a DIP rocker switch available through the left side of the case.

I often wanted to go off-line and into the half-duplex mode to "talk to myself" locally on the TV set, and set colors and experiment with graphics before trying to write a program. But this required manipulation of the rocker switch with some tiny, pointed instrument.

The "local-line" switch is right next to the switch which selects between RS-232C and current loop operation. You could easily knock yourself into the wrong transmission mode when selecting on- or off-line. I would suggest a separate on/off line switch as a minimum, and a separate half/full-duplex switch would be nice to have.

The DIP switch setting arrangement won't bother an installed user who simply wants to turn the system on and go, but if you are learning the system or doing any special local programming to use its capabilities, the DIP switches can be a nuisance.

The VP3303 has a built-in video modulator to provide a channel 3 or 4 rf signal to a TV set. The Model 3301, which sells for a little less, does not have the rf modulator. This family of terminals can provide a fine low-cost data communications capability, but they can also provide unique graphics, color and sound from any computer able to interface with a terminal.■



There is a line of DIP switches on the left side of the VP3303 which sets most of the operational parameters. Everything is easy to use, but having the local-line switch in this location can become a nuisance if it is needed frequently.

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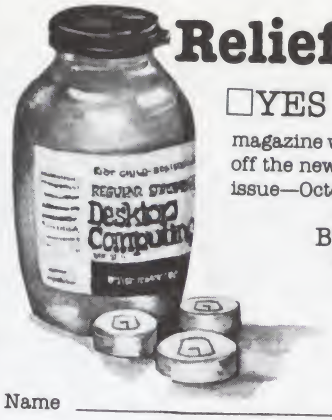

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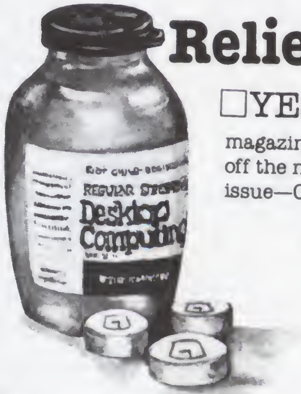

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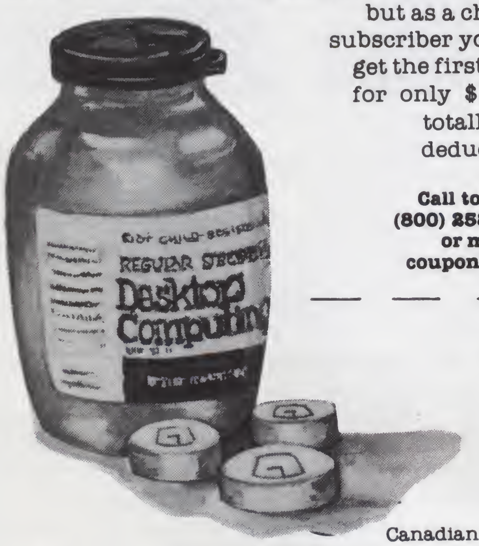

Here's a look at some of the articles $17.97 will bring you:

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Wayne Green, the publisher of Desktop Computing (and also of Kilobaud Microcomputing and 80 Microcomputing—both successful computing publications) has gone through both the agony and joys of working with computers. He has lost a quarter of a million on a mainframe big boy computer only to come out on the other side with all the frustration necessary to run a 200 employee publishing firm on several TRS-80's.

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ENGINEERING AND PRODUCTION CONTROL SYSTEMS

Company founder and president, Walter L. Myers (right), pictured with production engineer Joe Zellers who developed the production control software for the MSI computer system.

THE COMPANY:

MYERS SPRING COMPANY, INC. LOGANSPORT, INDIANA

Myers Spring Company, Inc. was founded 35 years ago by Walter L. Myers for the manufacture of small mechanical springs which are used widely in mechanical appliances, electrical equipment, and by the automotive, construction, and many other industries. The Myers Spring company has grown to several million dollars in annual sales and employs approximately 50 people in its production facility.

Production engineer Joe Zellers comments, "we began looking at computer systems approximately ten years ago in order to keep up with the increasing demand of order processing, custom mechanical spring design engineering, and production control. In 1975, we selected the MSI system because they were the first company in the microcomputer industry to offer the necessary peripherals which would convert a microcomputer system into a usable business system. Since 1975, the MSI system has been expanded to accommodate four users simultaneously, performing a variety of plant monitoring functions and management programs."

"The system is equipped with 10 megabytes of hard disk storage presently and we plan to add an additional 10 megabytes of storage soon. The maximum downtime has been only one or two days in the 5 years that the system has been in operation. MSI has provided excellent technical support and willingness to help us with our special requirements. We have nothing but praise for MSI, they have provided excellent system support."

The production facility at Myers Spring Co. is equipped with many automated machines for mechanical spring production.

SPRING ENGINEERING AND DESIGN

"All of the production at Myers Spring is performed to exact customer specifications rather than to the manufacture of standard spring products. This causes an ever increasing demand for quick and efficient design and engineering capabilities. Many parameters have to be taken into consideration in the design of any particular spring, including wire size, wire type, material modulus, spring diameter, number of turns per inch, free length, spring loading, rate, solid height, working stress, working temperature, number of operating cycles, hysteresis, resonant frequency, expansion, and whether the spring has to be ground or not. It used to take over an hour for an engineer to design a spring taking into account all of these parameters. However, with the engineering software which we have developed for the MSI system, spring design can be completed in less than one minute by simply keying in the desired parameters. The MSI computer system not only designs the spring for us but prepares a complete quotation for the customer after consideration of the material to be used, the amount of waste, which equipment the production will use, the speed of the machines, the necessary labor rate, as well as the desired percentage of profit."

One of four workstations where design engineering, checking of sales order status, and production control monitoring is performed.

SALES QUOTATION SYSTEM

Following the computer spring design procedure, with automatic quotation feature, the actual production begins. Each quotation is reviewed and compared to actual job cost reports on the production run in order to make any necessary refinements in the quotation system software. This feature of our system has greatly improved our ability to prepare accurate quotations and to insure profitability of the company.

PRODUCTION CONTROL/JOB COST ACCOUNTING

Each production work order is tracked by the computer system at each stage of the production process. First, each order is checked against the customer quotation for accuracy. As each order is processed, exact shop labor time is recorded, for each production machine used, and each stage of the production process. Summary reports are produced showing the total amount of material used, time used on each production machine, amount of material used, and a total cost figure for each work order.

SALES SUMMARY REPORTS

The system is designed to produce monthly sales summaries which show the amount of products sold by each salesman, complete with dates, order numbers, type of product, quantity, type of material, material cost, sales commissions, etc. Totals for each desired category and for each salesman are reproduced.

ACCOUNTS RECEIVABLE SYSTEM

Each morning, invoices are generated for orders which will be shipped that day. The accounts receivable system maintains accounts for over 500 active customers. The system produces monthly statements complete with aging of open invoices.

MULTI USER CAPABILITY

The MSI system is equipped with four user terminals presently which are available for use simultaneously by the following departments: Order department, for entering new orders and checking order status. Inventory department, used for checking to see whether a particular product has been produced previously. Invoicing/Cost Accounting, used for preparation of invoices and for entry of labor and material cost accounting information. Design Engineering, used by company engineers to design new products.

Order entry, invoicing, monthly statements, and other management reports are carried out at this workstation at Myers Spring Co.

The MSI system at Myers Spring Company is equipped with 10 megabytes of hard disk memory, dual floppy disk drives, a high speed printer, and four user CRT terminal workstations.

GENERAL LEDGER TIE-INS

The MSI system automatically prepares journals for cost accounting information and sales data which can then be posted to the general ledger. Complete income statements and balance sheets are produced by the general ledger programs on the system.

MULTIPLE MANAGEMENT REPORTS

The MSI system is used in many different areas of the company in order to provide more efficient and effective management of our production facilities. Several of the reports which we obtain from the system are: **production schedules, due list for orders, new orders list, production summary by department, salesman's reports, individual customer reports and order histories, time studies, sales quotations, design engineering, sales summaries, customer statements, general ledger balance sheet and income statements.**

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The day when we can affordably hook our micros up to the television camera is fast approaching. Until then, let's imagine the ideal "eye for your computer."

Lights . . . Camera . . . Action

By James M. Hansen

Of the many microcomputer peripherals available, the television camera is probably the most fascinating. The gift of sight to a computer can open the door to a host of uses not otherwise possible, including motion study, cartography, image analysis and robotics.

While I don't want to get too bogged down in detail, I want to discuss some of the problems of making a high-performance television interface. Hardware is now available, and affordable enough so that advanced hobbyists can actually start planning such an interface.

The ideal interface should accept any standard television signal, digitize it (convert the picture portion into a string of numbers) and place it into memory. Further, it should do this to a single frame; that is, one complete scan of the picture. This takes 1/30 of a second for U.S. television signals.

The successful interface should also be able to display the image on a monitor with the same resolution that was used to digitize the original image. System resolution must be at least as good as that seen on a standard home television set.

Our ideal interface would also provide at least 32 shades of gray scale. This corresponds to five bits of information for every dot that you digitize. The more shades of gray you can get, the more natural the shading of the pictures you digitize. Line drawings, maps, cartoons and the like generally look fine with only one bit of information (dot on or off) per displayed

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Address correspondence to James M. Hansen, Box 234, New Boston, NH 03070.

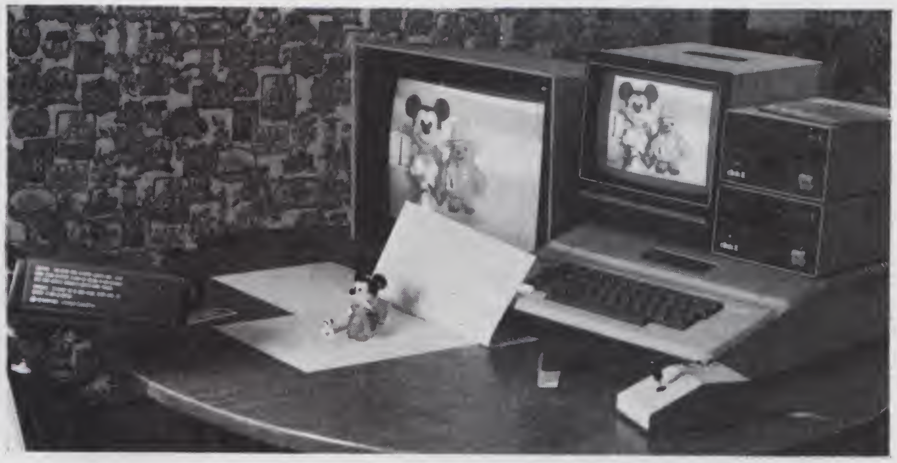
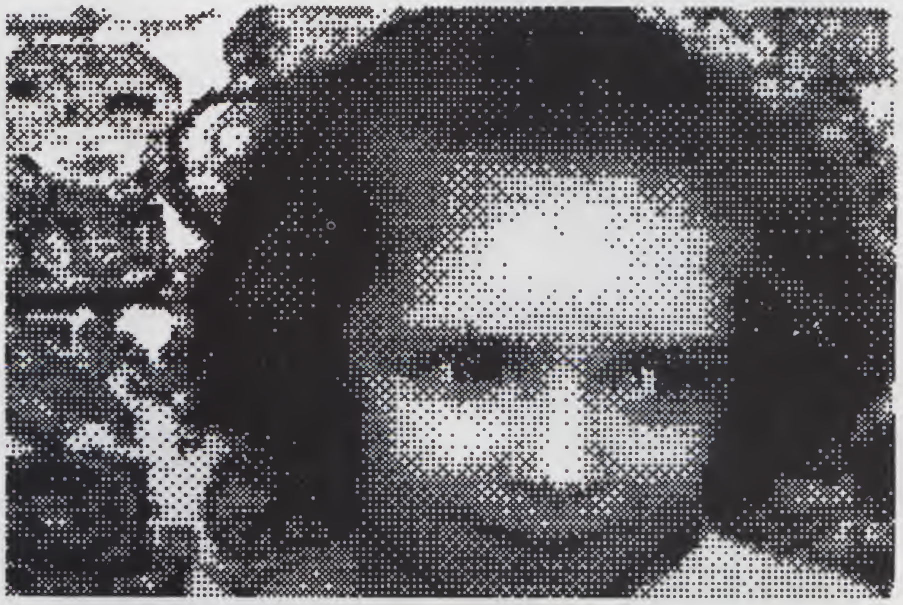


Photo 1. The photographic setup used to make the stereo pictures. The larger monitor displayed the picture directly from the camera, and the smaller monitor atop the Apple shows the digitized image. Careful lighting is necessary to get maximum detail.



Sample 1. This is a picture of one of my children. One of the problems of child photography is getting them to hold still long enough (three or four seconds) for the entire image to be digitized. The background in this case is distracting and probably should be something with little or no pattern.

dot, but actual photographs and most other video images require a gray scale to be recognizable.

This, then, is the ideal interface: with the press of a button, it will snap up a single frame of video from almost any source, put it into some kind of digital memory which can be read and stored on disk in normal computer fashion, and display the frame on a monitor with picture fidelity as good as that found on most network broadcasts. Can it be done today at a reasonable cost?

Yes, If . . .

The answer is yes, if you design and build it yourself.

Let's look at what we have to understand to build the ideal interface.

First, the video signal. Fig. 1 shows in some detail the standard used in the United States. The major portions that concern us are the vertical interval, which will indicate the beginning and end of a picture frame, the horizontal sync and blanking pulse and the video portion of the signal.

A complete video frame consists of 525 horizontal lines. The frame is made up of two fields. Each field consists of 12-1/2 lines that provide vertical synchronization information and 250 lines that contain picture information. The fields are overlapped so that one provides information for even horizontal lines in the picture, the other odd lines.

The odd field starts its scan in the center of the top line of the picture, and the even field begins at the top left of the picture, under the first line of the odd field. Each field is completely scanned in 1/60 of a second, and so a frame is completed in 1/30 of a second. The timing of the fields was chosen so that 60 cycle hum and interference would be less noticeable since it would be in sync with the picture and thus stationary (or nearly so).

Fig. 2 shows a block diagram of our ideal television interface. It consists of a video analog-to-digital converter and a high-speed memory to hold the digitized image, complete with an interface to your computer. A digital-to-analog converter and attendant logic to add vertical and horizontal sync signals for output to a monitor are also included in the interface.

The critical elements that determine the maximum picture fidelity are the analog-to-digital converter (ADC), memory speed and size, and the digital-to-analog converter (DAC). We will assume that sufficient hardware exists to strip out the sync portion of the video signal and synchronize the ADC properly to grab a frame starting at the beginning of the frame, rather than starting at some random place in the picture.

There are several types of analog-to-digital converters. For our purposes we will divide them into two classes: fast (of the flash variety), and slow (which use successive approximation or other standard techniques to digitize analog signals). It is now possible to buy single-chip monolithic ADC converters in the $10 range which do a respectable job. They are slow by video standards, but for this example, let's say that we located one that would do a single conversion to eight bits in ten microseconds (μs).

Since each horizontal line takes about 63 μs, at best this converter will give us 6.3 data points every horizontal line. It is therefore not acceptable for the ideal interface, but let's not drop it yet. We could divide up the horizontal line into, for example, 1200 data points and use this converter to digitize six points of every line each frame. If we move the six points we digitized a little every time, we could completely digitize a frame of video in 200 frames. At 30 frames per second, that works out to 6-2/3 seconds, practical for image reproduction of still objects at quite good resolution.

The real answer to our ADC requirement is the flash converter. This type of converter is fundamentally different from other converters. The normal, slow type of converter digitizes a signal by generating a test volt-

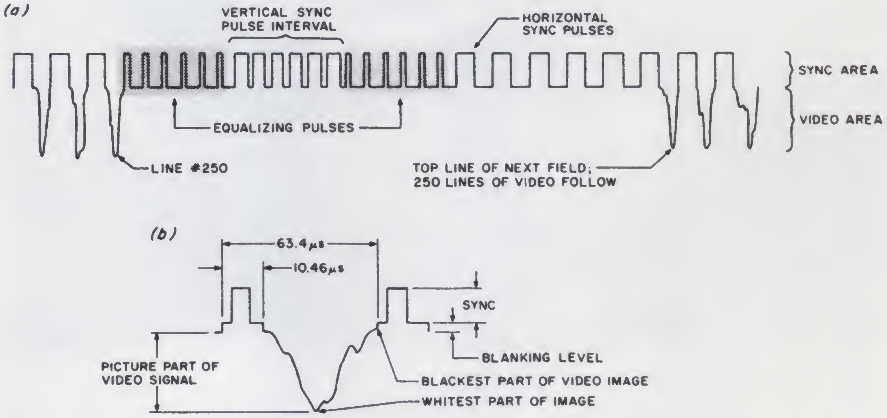
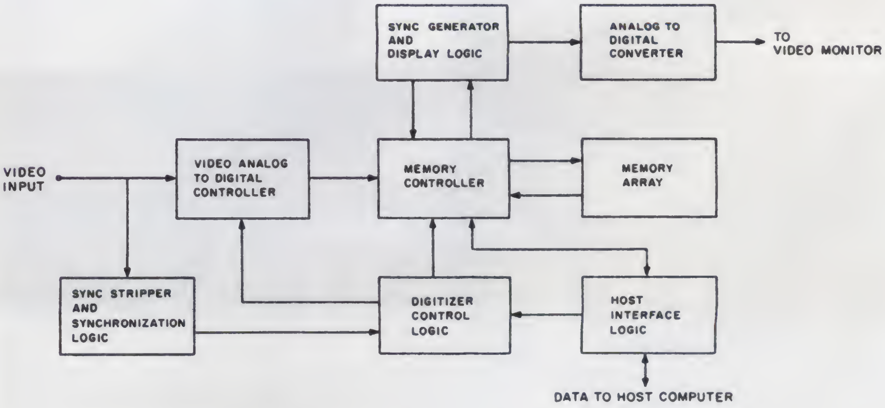

(a)
VERTICAL SYNC PULSE INTERVAL
HORIZONTAL SYNC PULSES
SYNC AREA
VIDEO AREA
EQUALIZING PULSES
LINE #250
TOP LINE OF NEXT FIELD; 250 LINES OF VIDEO FOLLOW
(b)
63.4μs
10.46μs
SYNC
BLANKING LEVEL
PICTURE PART OF VIDEO SIGNAL
BLACKEST PART OF VIDEO IMAGE
WHITEST PART OF IMAGE

Fig. 1. Standard (U.S.) television video waveforms. Fig. 1a depicts a complete field showing the vertical sync area, horizontal sync pulses and picture areas. The equalizing pulses surrounding the vertical sync pulse interval maintain horizontal sync in the television monitor during the vertical interval and provide for odd-even fields mentioned in the text. Fig. 1b shows the waveform for an individual scan line. The time for one line is shown for a black and white picture. Color scan times are longer, 63.5 μs per line. (This frequency was chosen as 2/455 times the color burst frequency.) The blanking and sync pulses are "blacker than black" since they extend past the blackest area of the video portion of the signal. The blanking pulse is used to turn off the video display while the beam is moved to the left of the picture for the next scan line. Many inexpensive vidicon cameras combine the sync and blanking pulses into a single rectangular pulse.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VIDEO INPUT
VIDEO ANALOG TO DIGITAL CONTROLLER
MEMORY CONTROLLER
MEMORY ARRAY
SYNC STRIPPER AND SYNCHRONIZATION LOGIC
DIGITIZER CONTROL LOGIC
HOST INTERFACE LOGIC
DATA TO HOST COMPUTER

Fig. 2. A block diagram of the ideal television interface.

age and comparing it to the input voltage. The test voltage is adjusted until it matches the input voltage within the tolerance of the converter. Since the converter uses digital techniques to generate the test voltage, the digital value can be read out when the input and test voltages are matched.

The flash converter obtains greater speed by using many comparators (and an equal number of test or reference voltages) simultaneously to determine the input voltage. The outputs of the comparators are sent to an encoder that generates the digital value of the input voltage. If we had an eight-bit flash converter, it would have 256 comparators and voltage references built into it. Getting all the comparators and voltage references to be accurate in relation to each other, plus mixing analog and digital logic on one chip is no mean feat, but it is now done by both TRW and Analog Devices.

TRW's converters have been on the market for some time, and command a fairly high price. Analog Devices has just introduced two monolithic flash converters, the AD5010KD and AD6020KD. They are packaged in a 16-pin DIP and are priced at $189 and $84, respectively, in hundreds. All that is required is two power supplies, an input signal and a TTL encode command.

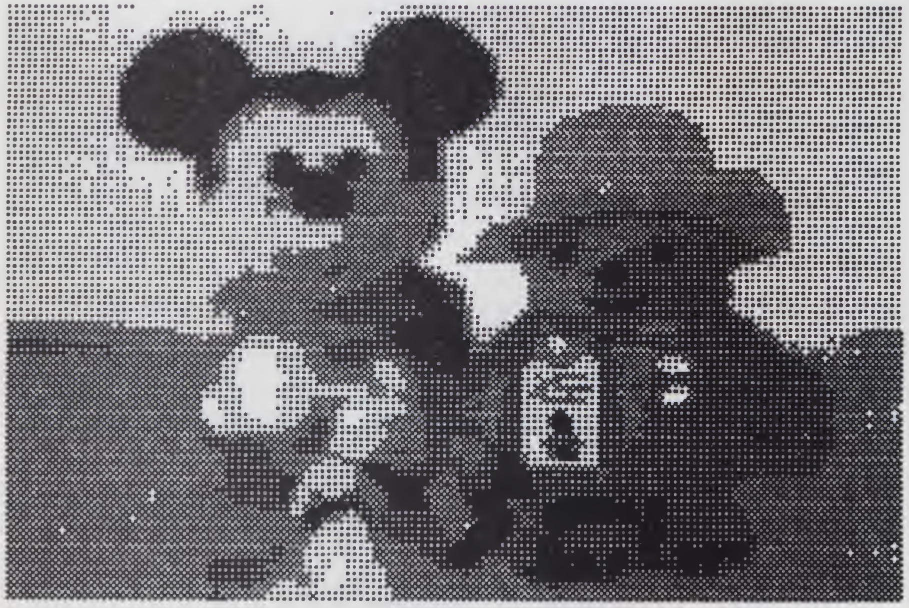
The AD6020 digitizes data at rates up to 50 million conversions per second, and the AD5010 up to 100 million. That translates to 20 nanoseconds (ns) for the slow one, and 10 for the fast one. Since the data can be encoded faster than the gate propagation times (the time it takes an input signal to reach the output of a gate) of standard TTL logic, these converters will require use of Schottky or ECL logic to be run at full speed.

Look at the resolution we can get using these relatively low-cost devices. A conversion rate of 20 ns/conversion gives 50 samples per μs, or about 3200 readings on a single horizontal video line. This is clearly sufficient for our ideal video interface. Since these converters digitize to six bits, we will get 64 shades of gray, again satisfactory for our interface.

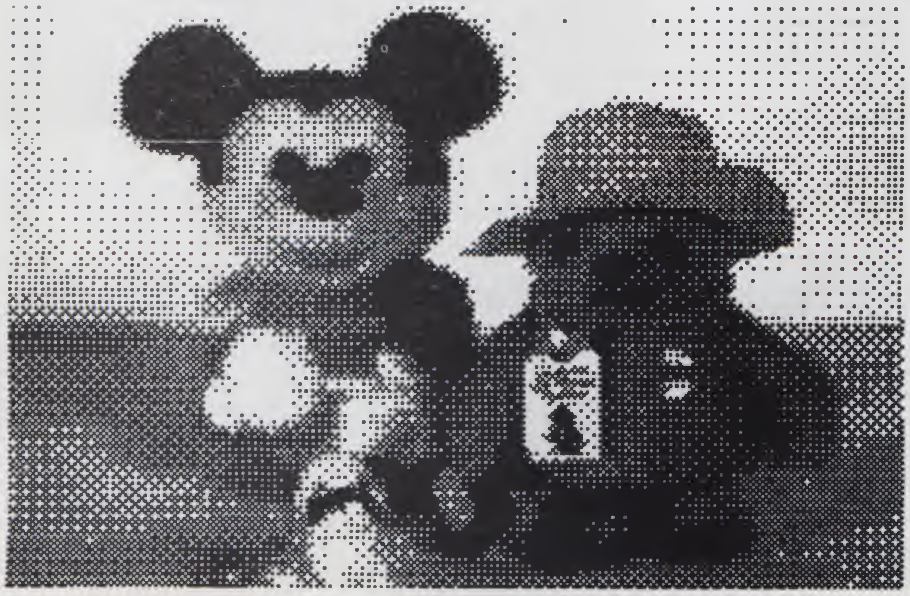
Before you rush out and buy your converter, I want to quote a sentence from the Analog Devices announcement: ". . . it is important to note that the design principles for high-speed conversion have not been revoked by the availability of a chip that does most of the work." They also mention that a complete board for prototyping is available. It would appear that it is now possible to build the front end of our high-*performance* video interface with confidence *it* will work.

Next we must design a memory that will accept data at the rate our converter produces it. First we should look at how much memory we need. This is entirely dependent on the desired resolution. Say that we would like 1024 dots (picture elements, or pixels) per horizontal scan line. Since there are 500 lines in the frame, we are talking about a half megabyte of memory, a practical amount by today's standards. Our problem here is that there aren't too many cheap 20–60 ns memories around.

The memory array we need would consist of 32 banks of 16K byte memory chips, or eight banks of 64K parts. Since 64K memory chips are quite expensive and/or not readily available,



Sample 2. Mickey Mouse (patron saint of computer hackers everywhere) and Paddington Bear were two figurines chosen for several experiments. Sample 2a (top) shows the image with a dither matrix of two (four shades of gray); 2b (bottom) used a matrix of four (16 shades). Notice that the images seem a little fuzzier (loss of detail) in 2b, but are better defined because they are separated from the background. I found that the image displayed on the Apple monitor often looked better than what was printed. It takes a bit of effort to adjust the monitor contrast and brightness to "match" the printer output.



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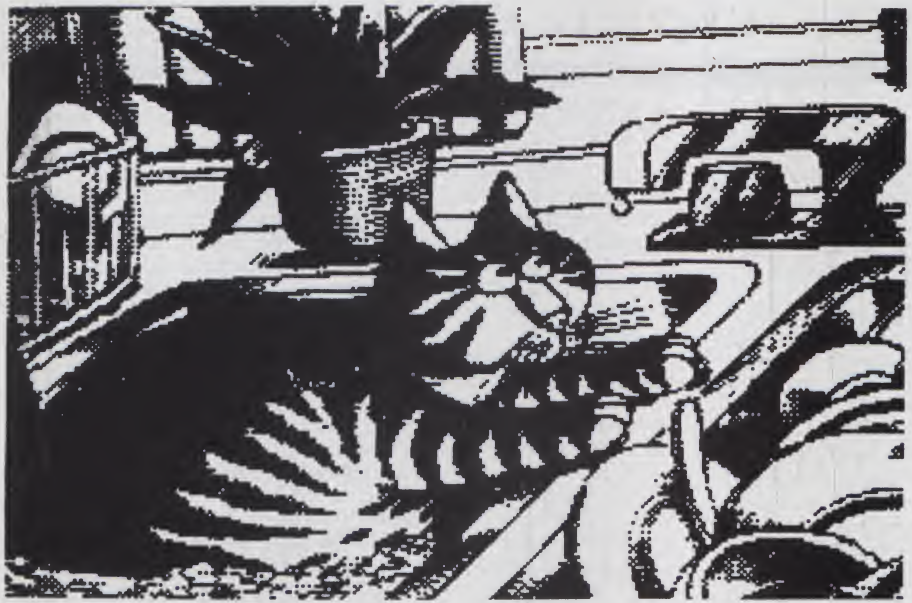
we will think along the lines of using 192 16K chips. They can be had for under $5 each, and so the bulk of our memory unit will cost under $1000, if you build it yourself.

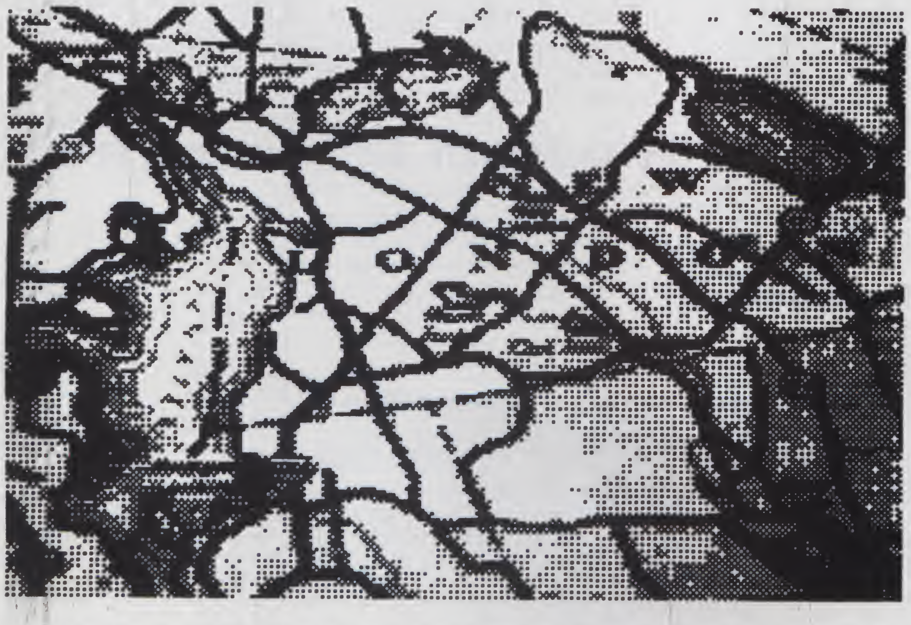
Since the standard 16K memory access time is around 150 ns, some paging scheme will have to be employed to allow proper setup and access times. We will need to access the memory 1024 times each 63.4 μs, which works out to once every 61.9 ns. We can either set up the memory as several pages and write each datum to another page, or splurge and use 120 ns memories and design a two-page system. The two-page system will be easier to design and get running.

The final video section is the playback or memory display section. Here again, high data rates will require a good deal of thought and a fast digital-to-analog converter to realize high-quality output. There are many suitable fast DACs available. Horizontal and vertical synchronizing signals must also be generated and mixed with DAC output.

Since one of the main objectives of the interface is to allow a computer to process the video image, a third interface to the memory must be provided for computer access. I can see no requirement for either display or data capture during computer access, so this will take some burden off the memory design. It might be interesting to note the time it would take to unload this memory. If the computer access port were set up as a parallel port, and each byte required, say, 50 μs to be read by the host, and no disk access time delays were encountered by the host, it would take about 25–30 seconds to read it out. If floppies were used to store the data, you would probably want to devise a special disk format to hold the video data since standard formats have more overhead, thus less capacity.



Sample 3. This is an example of digitized line drawing. Line drawings generally look good as long as the lines are not too thin to be resolved by the Apple screen. Notice the staircasing (also called "aliasing") of the horizontal lines. This is caused by the resolution of the display being so low that the effect is visible. Staircasing will always be present in any digital display; the trick is to use enough lines to make it invisible.



Sample 4. A map of the New London area of New Hampshire. It was made with four shades of gray, which cost detail, but allowed the shading to appear. Some of the larger highway route signs are legible when no gray scale is used, but other details including some roads are lost. Best detail recovery is obtained with strictly uniform lighting and black and white objects.

But Seriously, Folks

All the foregoing is really a dream. If there are any of you out there that have the financial, technical and grit capacity to build even a subset of the ideal video interface, I would like to talk to you. I would guess it would take over $2000 to complete and probably six months to a year of intensive effort to get the hardware up and running.

However, there are at least two practical, off-the-shelf television interfaces that are available today. Neither has performance approaching the ideal, but as the fellow who owns a Piper Cub tells the one who dreams of an F-16, "they sure beat hangar flying."

The first has been around for quite some time and is sold by Micro Works (PO Box 1110, Del Mar, CA 92014, 714-942-2400). It is slow, but quite inexpensive and works through a parallel port. My understanding of its operation is that you send it an address and it returns a digital value of the addressed portion of the image. This makes the data it returns similar to that of the ideal interface.

Computer Station (11610 Page Service Drive, St. Louis, MO 63141, 314-432-7019) has recently introduced their Dithertizer II, which I have used for some time. It plugs directly into an Apple interface port and takes less than five minutes to install. It comes with a short manual, a disk with machine-language driver routines and a BASIC demo program. Your Apple must have a disk. The Dithertizer II requires a TV camera that accepts external sync.

The price of the Dithertizer II and a Sanyo vidicon camera is $650. This includes a long camera cable, so all you need to start operation is a tripod on which to mount the camera.

The manual is complete and gives good, clear installation instructions, reasonable operating and user information on integrating their various screen-dump programs (see "A Tale of Two Screen Dumps" in the April 1981 issue of *Microcomputing*, p. 174) and a source listing of the BASIC demo program. (If you want screen dump capability, you will have to purchase this program separately.)

Operation of the Dithertizer II is not the same as the ideal interface or Micro Works digitizer. Instead of storing numbers corresponding to the value of the video signal, a translation is made based on the dithering matrix size, and an appropriate number of display dots in the Apple high-resolution graphics display memory is turned on and off to render a gray scale.

All output of the Dithertizer II is sent directly to the video display memory. A dithering matrix of 1×1 (no gray scale, only black or white is displayed) to 8×8 (64 apparent shades of gray) may be selected. An unfortunate consequence of using larger dithering matrices is that, because of Apple's limited resolution (280×192), image detail is lost. Another consequence of storing information in this format is that, while it is perfectly natural for display purposes, it is difficult to process the data in any way other than to store or dump it on a printer.

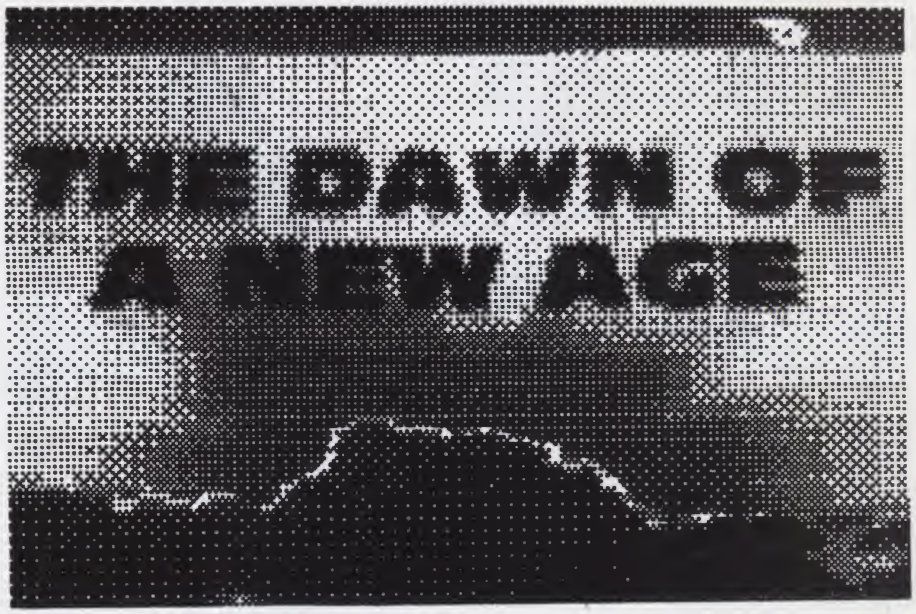
The demo program, written in BASIC, is designed to let you use the system as soon as you have everything plugged in and running. Both the keyboard and game control paddles are used. Single keystroke commands are issued to the controller to dither (capture a picture), change the dither matrix, stop dithering and freeze the image, save the image to disk, print the image if you have installed their screen dump program for your printer and contour an image (draw an outline of its light and dark borders). The game control paddles are used to adjust the software equivalent of brightness and contrast.

Variables for controlling the dithering and contouring processes as well as machine-language entry points for these routines are clearly spelled out and can easily be driven by your own BASIC or assembly-language programs. Any questions that may arise are easily answered by reading the source listing of the demo driver program.

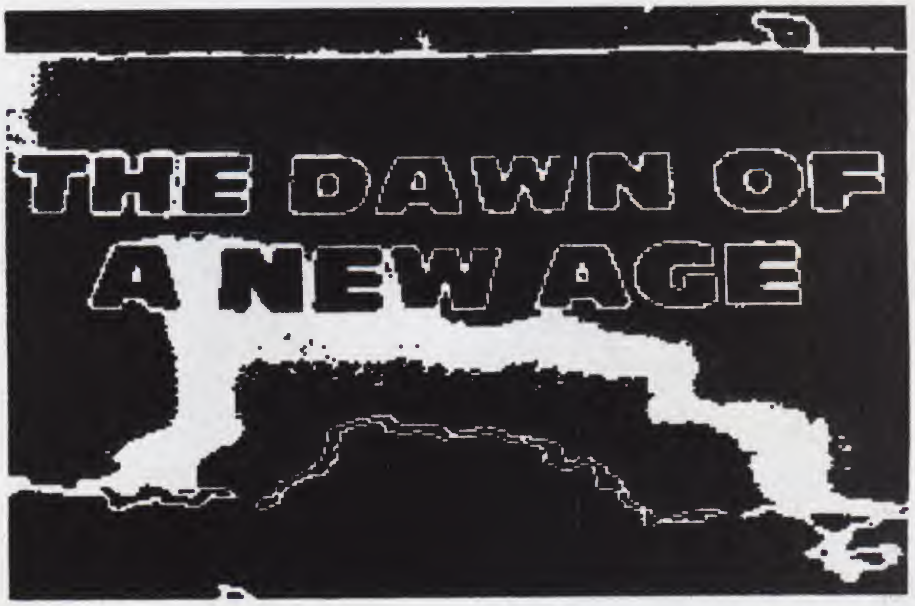
I installed the printer driver software for the Paper Tiger 460, and all the print samples shown were printed with the 460. Each of the pictures shows one aspect of the operation of the Dithertizer II. Photo 1 shows the setup I used. I found that uniform lighting was absolutely essential to get the best pictures. Also, a video monitor to observe the video input is necessary. Without it you cannot tell if the camera is focused or if the image is smudgy because of poor lighting. Getting the hang of adjusting the camera, lights and the game paddles takes a little time.

I tried to use one of the Programma joysticks, but found that the game paddles worked far better for me. It is hard to change just one axis on the joystick, and the backlash in stick movement causes confusion when a small adjustment is required.

The Sanyo camera supplied by Computer Station works well, but the lens does not have an iris. It is not



Sample 5. This was copied from a color advertisement, and dramatically shows the ability of the Dithertizer II to locate the edges of a video image. Sample 5a (top) is the normal picture, and 5b (bottom) the "contoured" version. Careful adjustment of the game paddles is necessary to obtain this clarity.



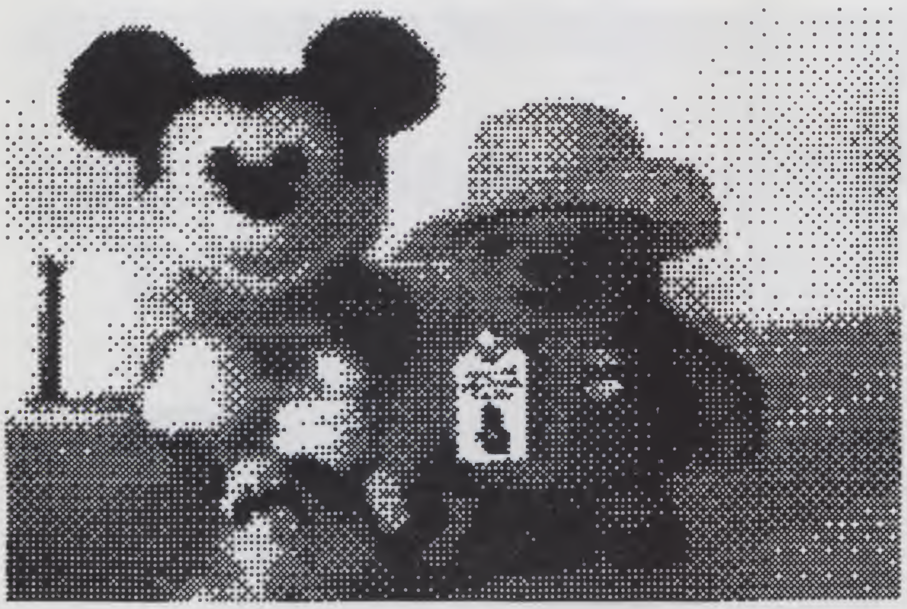
possible to adjust the depth of field or to compensate for peculiar lighting conditions. It does have a very effective electronic light compensation circuit which can be annoying at times since one small bright spot in the picture area can cause the rest of the picture to be washed out.

The normal beam and target controls are screwdriver adjustable, but the (Sanyo-supplied) manual merely says not to adjust them and lets it go at that. (Could it be that the Japanese are finally learning to write American-style manuals?)

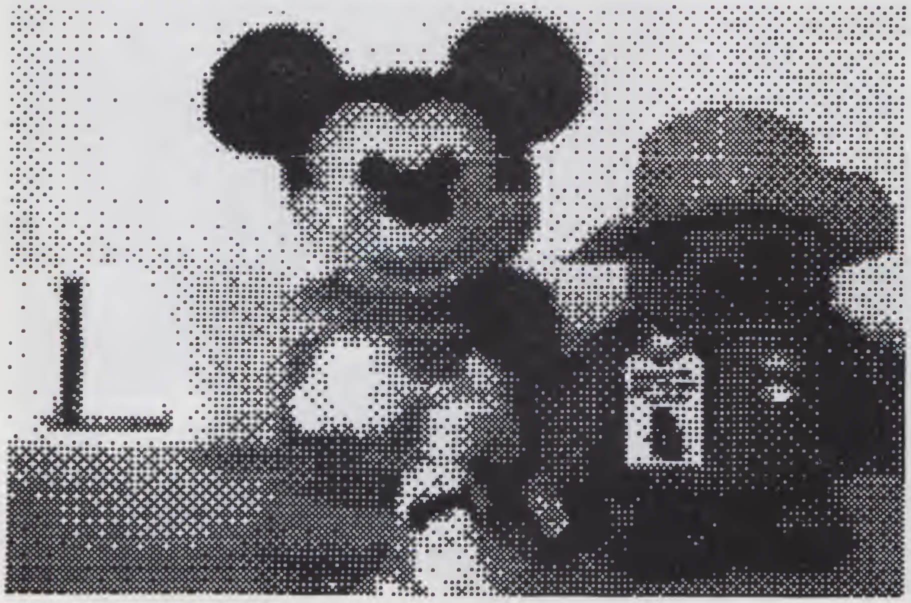
One very good feature of the camera is that the vidicon can be moved in and out in relation to the lens, thereby allowing it to focus inches away for extreme closeups.

Many Applications

As can be seen from the various print samples, the Dithertizer II can be used for many applications. It can grab a single frame only when using the 1 × 1 matrix, and takes several seconds when an 8 × 8 (64 gray scale) image is to be digitized. Its resolution is limited to that of the Apple high-resolution graphics display. It is, however, a practical, high-quality television interface that works without a hitch right out of the box.



Sample 6. *A stereoscopic pair of pictures. Properly aligned and viewed through a stereoscope, a small dog figurine will appear in front of Paddington Bear, then Mickey to the left and farther back, and finally the L. The pictures were taken in the typical manner, except the camera was moved to the right for the bottom picture.*



The comments in the captions on the print samples explain in detail what was being done to show the various capabilities of the Dithertizer II. My personal impressions of this unit are that it can digitize live television images from a camera and display them to the capability of the Apple's high-resolution graphics display. The catchword here is display. I do not think that it will be possible to do a lot of image processing—that is, computer enhancement and the like—without a considerable amount of work in 6502 assembly language.

But for applications where a television camera, image display and printout are useful, this is a very workable system. I had originally hoped that the resolution would be sufficient to be useful in storing maps. I found that coloring and shading on typical road maps caused trouble since they appear as different gray levels and smudge. Also, the Apple display just does not have enough resolution.

The search for the ideal video interface goes on. I suspect that in the next couple of years we will see the cost of suitable equipment come down with a corresponding decrease in circuit complexity. When this happens a whole new area of exciting microprocessor development will open up.■

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Data Acquisition Handbook. National Semiconductor, 2900 Semiconductor Drive, Santa Clara, CA 95051. A catalog of National's data acquisition products including analog to digital converter chips. Some useful application notes.

Analog to Digital Conversion Notes. Analog Devices, Inc., Box 796, Norwood, MA 02062. A must for anyone working with A-D conversion and analog data processing. A most readable and well-written book. Well worth the $7.95 price.

Analog Dialog—Vol. 15, No. 1. Analog Devices. A description of the AD5010KD and AD6020KD flash converters.

General Catalog. Burr-Brown, PO Box 11400, International Airport Industrial Park, Tucson, AZ 85734. A complete listing of their data acquisition products including some application notes.

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Perhaps the class of the Japanese computers targeted for the U.S. marketplace is NEC's PC-8000.

Japanese Invasion: Part 3

By G. Michael Vose
Microcomputing Technical Editor

While Casio and Sharp have managed to produce competitive new microcomputers for the American marketplace, the most talked-about new Japanese computer is the Nippon Electric Company's (NEC) PC-8000. This Z-80 based machine has been favorably compared to California's Apple computer. Because of the similarity, industry experts seem to feel that NEC has the best chance of securing a significant slice of the U.S. personal computer market.

The PC-8000 (when will the Japanese name a computer the "Cherry Blossom" or the "Mt. Fuji"?) supports color, is as fast as the Apple or the TRS-80 and has a competitive price tag. NEC has done its homework, too, in preparing the kind of solid, professional support that fancy hardware needs—software, documentation and training materials.

The PC-8000

NEC's new microcomputer is an amalgam of several separate components. The PC-8001A keyboard unit contains the microprocessor and 32K bytes of user memory. The PC-8011A expansion unit that came with the unit tested here at the *Microcomputing* editorial offices contained an additional 32K bytes of user memory plus a 24K byte N-BASIC ROM interpreter and an 8K byte custom PROM, the PC-8031A dual disk drive unit and the PC-8041A monochrome monitor. System options include the PC-8032A disk unit, which permits expansion of the system to four-drive capacity; a PC-8023A dot matrix printer; the PC-8043A color monitor; the PC-8012A expansion unit (this expansion unit has more I/O ports than the PC-8011A); and a cassette tape recorder.

All components are housed in metal or plastic cases; the color of the components is a standard off-white or cream color. The monochrome monitor has a green phosphor screen which will support 80 or 40 characters by 20 or 25 lines. The N-BASIC command, WIDTH x,n (where x = characters and n = lines), allows you to control the display size.

The keyboard features 77 keys plus five special-function keys. These keys are separated into a standard typewriter-like keyboard and a numeric keypad. There is a standard English character set, and an alternate Greek character set which can be called by simply pressing the ALT CHAR key. There is also a graphics character set, which is called by pressing the GRPH key. This graphics set includes lines, circles, dots, triangles, playing card symbols and a variety of other graphics images.

The PC-8000 features inverse video

The NEC PC-8000 system includes a monitor and dual double-density disk drive unit.

G. Michael Vose is a technical editor for Microcomputing *magazine. His review of the Casio FX-9000P appears on page 101 of the September issue, while his review of the Sharp YX-3200 is on page 90 of the October issue.*

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capability, including inverse field blinking. The on-board editor is a screen editor, not a line editor. The computer has terminal software in ROM so that it can be used as a terminal for another computer. This terminal capability is accessed from N-BASIC using the command TERM(w,p, c,a), where w=word length, p=parity, c=clock drive ratio and a=auto line feed. Once in the terminal mode, the PC-8000 can communicate with other equipment through the RS-232C interface.

The PC-8000 disk-based system will operate under NEC's proprietary operating system, called NECDOS, or the CP/M operating system. The disk drives are double-density controlled and will allow the storage of 177K bytes of data per formatted 5¼-inch disk.

This computer complies with FCC regulations regarding radio frequency interference (rfi). The unit tested did interfere with a television near it and plugged into the same wall socket. This situation was remedied by moving the computer a short distance away from the television.

N-BASIC

The BASIC chosen for the PC-8000 is a Microsoft, Inc., BASIC called N-BASIC. It's similar to other versions of Microsoft BASIC running on the Apple, Radio Shack and Commodore micros. It is a powerful BASIC, containing a variety of commands unique to the PC-8000. It permits the access of the machine-language level of the computer from BASIC, using PEEK and POKE, USR and VARPTR.

The Z-80A compatible processor running on a 4 MHz clock makes the execution of the PC-8000 N-BASIC commands as fast as on the Apple and TRS-80. This is a contrast to the Casio and Sharp computers, which were much slower. N-BASIC uses floating point arithmetic (integer division is also available, a feature that will save a few bytes of code), single-precision numbers to seven places and double-precision numbers to 17 digits.

At the Top

From a hardware point of view, the PC-8000 is a solid, professional product. The system's best feature, however, may be its documentation and training materials. NEC has spared no expense to provide as much written information about the system as possible—with one exception.

As a former documentation technical writer, I'm impressed more than most by good documentation. The PC-8000 documentation impressed me a great deal. It includes reference manuals for each individual piece of hardware except the monitor. There are separate reference cards summarizing the N-BASIC commands, plus a card cross-referencing N-BASIC commands with their equivalents in Apple, Radio Shack and Commodore versions of BASIC. The N-BASIC reference manual is complete, well-indexed, neatly organized and attractively printed. In addition to these manuals, there is a user's manual that presents a system overview.

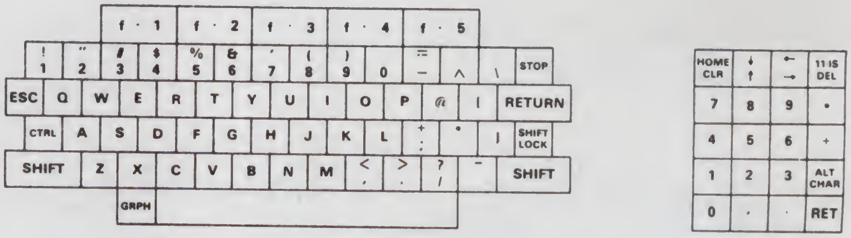
There is one glaring omission, however. Except for instructions on how to format and to back up a disk, there is virtually no information on the NECDOS. There are seemingly no utilities for the system—or at least no mention is made of any.

NEC apparently felt that all these materials were not enough, however. In addition to these manuals, there is a PC-8000 training program, a package that combines text with audio cassettes to teach the novice how to set the system up, turn it on and begin writing simple N-BASIC programs. There is an introduction to computer math and instructions on disk and printer use. There are separate training programs for the two principal pieces of software that NEC has purchased to support the PC-8000.

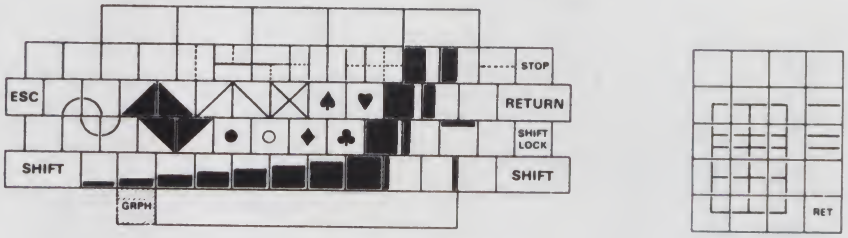
Software Support

NEC has recognized the fundamental need for software support. The company has selected two software packages and tailored them for the PC-8000. These packages include the Benchmark Word Processing system and the Target Planner. The Benchmark package is a product of Metasoft Corporation and the Target Planner originates with Advanced Management Strategies, Inc. The Target Planner is a VisiCalc-type "what-if" business projection package. Both packages are high-quality software offerings, and NEC has enhanced them by customizing the manuals for the PC-8000. AMSI will produce the training program for the Target Planner.

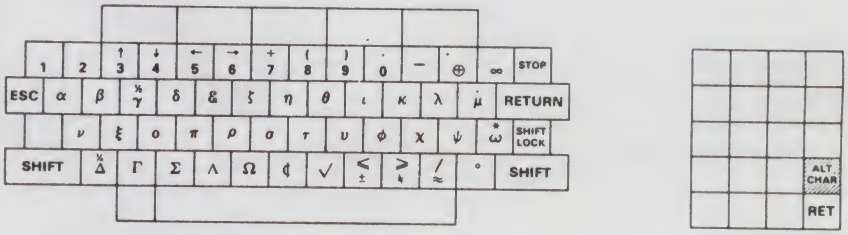
Since the PC-8000 operates under the CP/M operating system, the entire existing CP/M library of software will be immediately available to the PC-8000 user. This software will make the PC-8000 a serious contender in the small-computer marketplace.■



Standard keyboard.



Graphics characters.



Alternate character set.

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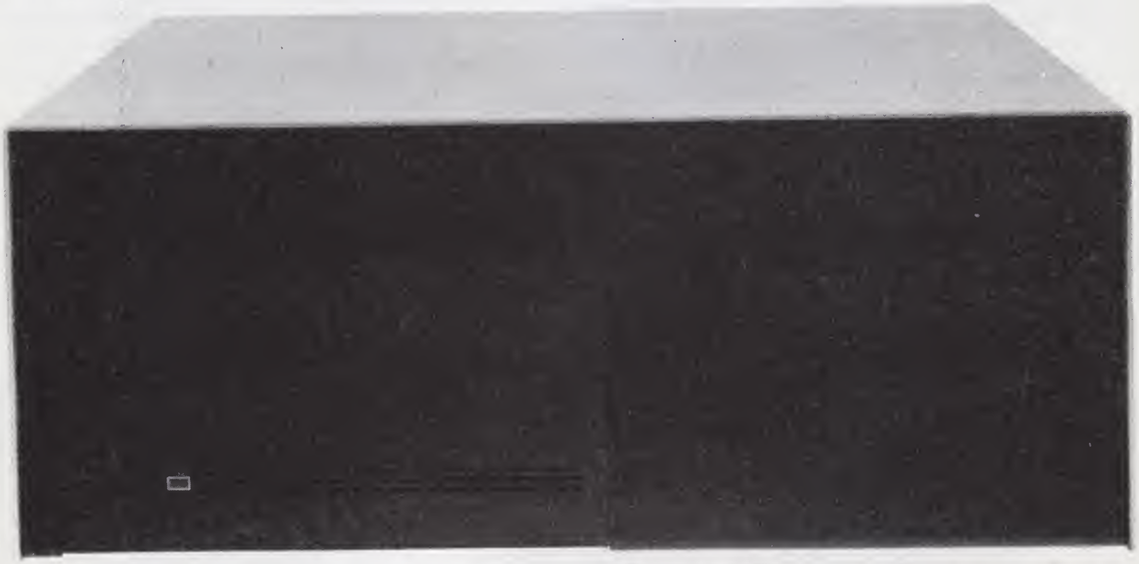

laredo systems inc.

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Here's a powerful, yet easy-to-use, BASIC assembler that can assemble any size program.

A BASIC Assembler For the PET

By Robert Baker

This simple yet powerful two-pass assembler for the Commodore PET directly generates loadable program disk files. It is written entirely in BASIC so it should run on all models. All disk commands are sent via the disk-command channel so the assembler will work with either DOS 1.0 (2040 disks) or DOS 2.x (4040 or 8050 disks). The programs require a Commodore Floppy Disk and at least 8K bytes of memory. A printer should be used to take full advantage of the features provided.

However, it is designed to be run on the 40-column screens and has not been upgraded for the newer 80-column machines.

Even though I wrote the assembler in BASIC, average assembly times are one to two seconds per line of source code on the second pass. I tried to improve the assembler performance by limiting available functions and by doing certain prechecking of fields with the Editor program when creating the source files. As such, this package must be used as designed for best results.

The major advantage of this assembler is that it can assemble any size program, since the source files are stored on disk. Also, since the output is actually a loadable program file, the address range used is not restricted, as long as each program is one contiguous block.

n	a decimal number example: 12369
$n	a hexadecimal number with a dollar sign ($) prefix example: $A0F2
symbol	symbolic value, value of symbol specified example: TAG12
*	the current program counter value
char	ASCII literal, equals ASCII value of first character after the apostrophe (') example: 'S

Table 1. Instruction and assembler directive operands.

value *or* +value	positive value of operand
−value	Two's complement 16-bit value
value1 + value2	adds value2 to value1 enters 16-bit result
value1 − value2	subtracts value2 from value1 enters 16-bit result
value1/value2	divides value1 by value2 enters 16-bit result

Table 2.

Editor

The Editor program (Listing 1) provides several basic functions for creating and maintaining source files for input to the Assembler program. Each function lets you have a printed copy of the source file being written or read. This program must be used when creating or editing files, since the Editor makes several checks to save running time of the Assembler program. Also, the Assembler expects to see the source lines in a specific format in the input file. The Editor also provides a means of printing program files saved on disk.

Creating Source Files

The Create function produces an original source file from data entered at the keyboard. Each line of source code consists of from one to four fields: label, command, operand and comment. The label, operand and comment fields are optional but each line must have a command before it will be accepted by the Editor.

One exception to this is a full-line comment that starts with an asterisk (*). The Editor will not allow entry of more than a given number of characters in each field, and any illegal characters will be ignored. A comma (,),

Robert W. Baker (15 Windsor Drive, Atco, NJ 08004) authors Microcomputing's *PET-pourri column.*

colon (:) or quote (") cannot be used in any field due to PET handling of data files and these special characters.

Labels must start with a letter, but the remaining characters may be letters or numbers. A label cannot be longer than six characters in length. The command is either an instruction mnemonic with the appropriate address suffix or an assembler directive. The maximum length of this field is five characters. The operand field contains the instruction operand (if required), and must be 13 characters or less. See the Assembler description for more information on the format and syntax of the command and operand fields.

The comment field lets you include a 25-character comment in any line. Characters may be any alphanumeric or graphics character, except for the above-mentioned BASIC restrictions. For added convenience, you can enter a full-line comment of up to 50 characters instead of the regular four fields by typing an asterisk as the first character of the line.

Each source line will be displayed as two lines, with a blank line between them for a pointer. The current line number will be indicated as a prompt for input. The label, command and operand fields will be on the top line, with the comment on a separate line. A full-line comment will wrap from the top to the bottom line when exceeding the limit of the first line. An up-arrow pointer will indicate the current position on the line at all times when input can be accepted. If you select the print option, each line will be printed when it is written to the output file.

Once the Create function has been selected, the following controls are provided by the appropriate keys:

- The space bar moves the pointer to the first character position of the next field. A space typed in any comment field will be entered as a space character in that field and will have no other effect.
- A shift-space combination returns the pointer to the first character position of the current field. If the pointer is already at the first character position, it will step to the first character position of the previous field.
- The return key enters the current line if valid (i.e., a command is present or it is a full-line comment).
- A shift-return combination discards the current line, removes the line number from the line currently

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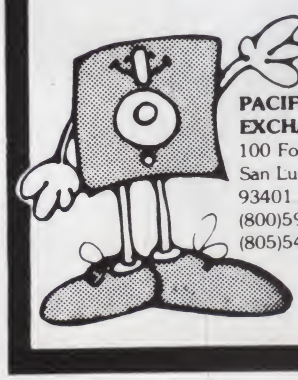

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- Expandable on-board up to thousands of words and phrases with additional speech ROMs (see new speech ROM described below).
- Four models, that plug directly into S100, Apple, Elf II and TRS-80 Level II computers
- Get ELECTRIC MOUTH to talk with either Basic or machine language (very easy to use, complete instructions with examples included).
- Uses National Semiconductor's "Digitalker."*
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one
two
three
four
five
six
seven
eight
nine
ten
eleven
twelve
thirteen
fourteen
fifteen
sixteen
seventeen

eighteen
nineteen
twenty
thirty
forty
fifty
sixty
seventy
eighty
ninety
hundred
thousand
million
zero
again
ampere
and

at
cancel
case
cent
400hertz tone
80hertz tone
20ms silence
40ms silence
80ms silence
160ms silence
320ms silence
centi
check
comma
control
danger
degree

dollar
down
equal
error
feet
flow
fuel
gallon
go
gram
great
greater
have
high
higher
hour
in

inches
is
it
kilo
left
less
lesser
limit
low
lower
mark
meter
mile
milli
minus
minute
near

number
of
off
on
out
over
parenthesis
percent
please
plus
point
pound
pulses
rate
re
ready
right

ss
second
set
space
speed
star
start
stop
than
the
time
try
up
volt
weight
a
b

c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s

t
u
v
w
x
y
z

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adjust
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alert
all
ask
assistance
attention
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button
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caution
celsius
centigrade
change
circuit
cigar
close
cold

complete
continue
copy
correct
crease
"de"
deposit
dial
door
east
"ed"
emergency
enter
entry
"er"
"eth"
evacuate
exit
fail
failure
fahrenheit
fast
faster

fifth
fire
first
floor
fourth
forward
from
gas
get
going
green
hale
heat
hello
help
hurts
hold
hot
in
incorrect
intruder
key
level

light
load
lock
longer
more
move
next
no
normal
north
not
notice
open
operator
or
pass
per
power
press
pressure
process
pull
push

put
quarter
range
reached
receive
record
reverse
red
repair
repeat
replace
room
safe
second
secure
select
send
service
side
slow
slower
smoke
south

station
switch
system
temperature
test
"th"
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this
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Acct. No. ______________ Exp. Date ______________
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State ______________ Zip ______________

```
LOC   -OBJECT-  LINE  .......... SOURCE CODE ............... < DASM V3.0 >

                  1  *
                  2  * SAMPLE ADDRESSING MODES
                  3  *
0000  6D 34 12    4          ADC    $1234          ABSOLUTE
0003  69 78       5          ADC#   $5678          IMMEDIATE; TAKES LOW BYTE
0005  65 01       6          ADCZ   1              ZERO PAGE
0007  71 02       7          ADC@Y  2              INDIRECT INDEXED; REG Y
0009  61 03       8          ADC@X  3              INDEXED INDIRECT; REG X
000B  75 04       9          ADCZX  4              ZERO PAGE INDEXED; REG X
000D  B6 05      10          LDXZY  5              ZERO PAGE INDEXED; REG Y
000F  6C 06      11          JMP@   6              INDIRECT
0011  D8         12          CLD                   IMPLIED...
0012  0A         13          ASLA                  ACCUMULATOR
0013  F0 01      14          BEQ    *+1            RELATIVE
0015  7D CD AB   15          ADCX   $ABCD          ABSOLUTE INDEXED; REG X
0018  79 00 04   16          ADCY   1024           ABSOLUTE INDEXED; REG Y
                 17  *
                 18  * OPERANDS & EXPRESSIONS
                 19  *
                 20  TAG     =      'A             ASCII LITERAL
                 21  TAG2    =      'XYZ           ASCII LITERAL; 1ST CHAR
                 22  ABC     =      1+$24          DEC+HEX#'S
                 23  X2G     =      150/11         DIVISION
001B  F0 04      24          BEQ    *+4            RELATIVE BRANCH
001D  D0 F8      25          BNE    *-8
                 26  YYY     =      'B+128         ASCII LITERAL + DEC#
                 27  T2      =      -1             NEGATIVE NUMBER 2'S COMP
                 28  T3      =      T2-2           SUBTRACT
                 29  *
                 30  * ASSEMBLER ERRORS
                 31  *
                 32          XXX                   BAD COMMAND/OPERAND
****  INVALID...              └ COMMAND
001F  00 00      33          ASL@X                 BAD ADDRESSING MODE
****  INVALID...                └ ADR'NG MODE
0021  F0 00      34          BEQ    *+200          INVALID BRANCHES...
****  INVALID...                    └ BRANCH
0023  D0 00      35          BNE    *-200
****  INVALID...                    └ BRANCH
                 36  TS      =      $XYZ           BAD OPERAND
****  INVALID...                    └ OPERAND
                 37  TS      =      1000           DUPLICATE SYMBOL
                 38  TS      =      123            2ND DUPLICATE
```

```
SYMBOL     HEX--VALUE--DECIMAL

ABC        0025            37
T2         FFFF         65535
T3         FFFD         65533
TAG        0041            65
TAG2       0058            88
TS         03E8          1000
******   MULTIPLE DEFINITION
X2G        000D            13
YYY        00C2           194

6  ERRORS
```

Sample listing.

Listing 1. DASM-Editor in PET BASIC.

```
10 REM ******* DASM -- EDITOR ********
20 REM *                             *
30 REM *    BY:  ROBERT BAKER        *
40 REM *                             *
50 REM ***** V1.2 **** 08/01/81 *****
60 :
70 :
80 PRINT"▓";SPC(8);"▓D A S M   E D I T O R"
90 CLR:U$="▓─────────────────────────────────┐"
100 B$="                                 "
110 Q$(1)="▓CREATE▓":Q$(2)="▓ EDIT ▓":Q$(3)="▓ COPY ▓":Q$(4)="▓ READ ▓"
120 Q$(5)="▓PRINT ▓":Q$(6)=Q$(5)
130 OPEN 15,8,15:CR$=CHR$(13):PRINT U$
140 PRINT"   0  -  ▓ DONE ":PRINT
150 PRINT"   1  -  ";Q$(1);" ──── NEW SOURCE FILE":PRINT
160 PRINT"   2  -  ",Q$(2);" ──┐":PRINT SPC(18)," ├ OLD SOURCE FILE"
170 PRINT"   3  -  ";Q$(3);" ──┤":PRINT SPC(18);"|"
180 PRINT"   4  -  ";Q$(4);" ──┤":PRINT SPC(18);"|"
190 PRINT"   5  -  ";Q$(5);" ──┘":PRINT
200 PRINT"   6  -  ";Q$(6);" ──── LISTING FILE"
210 PRINT U$:PRINT"SELECT DESIRED FUNCTION: ";
220 GOSUB 2610:F=V:IF R$="0" THEN PRINT"▓":END
230 IF F<1 OR F>6 THEN 220
240 GOSUB 2250:IF F>4 THEN GOSUB 2310
250 IF F>3 THEN 270
260 PRINT"DO YOU WANT A PRINTED COPY";:GOSUB 2630:IF A=89 THEN GOSUB 2310
270 ON F GOTO 310,1540,1810,2080,2080,1970
280 REM ======================
290 REM CREATE NEW SOURCE FILE
```

More →

displayed and allows restarting the line by displaying a new line prompt with the same line number.

- ●The clear/home key terminates the source file and discards the current line if anything has been typed but not entered with the return key.
- ●The cursor left/right key moves the pointer left or right within the bounds of the current field: The pointer cannot be moved past the existing characters in the field or the next space after the last character.
- ●The insert key lets you insert a character before the character being pointed to. Once the insert key has been pressed, a character must be typed and entered, or shift-return typed to discard the line. Insert cannot be used to exceed the maximum number of characters within a specific field.
- ●Pressing delete deletes the character currently pointed to.

Note that the cursor up/down and reverse keys are ignored.

Editing Source Files

The Editor lets you edit a source file while copying it to a new output file. The Editor will keep a copy of the original source file as a backup copy, in case there are any system errors. If you pick the print option, each line written to the new file will also be printed. When the first line of the original source file is displayed, select the desired edit mode from those available. At the end of the original input file, you can add lines to the end of the file. When you're done editing a file, the number of lines in the new file will be indicated.

- ●When editing the file line-by-line, each line is displayed a line at a time and may be edited as desired. *All* control functions may be used as described for the create function with the following differences:
- ●The shift-return combination will delete the current line and display the next line.
- ●The clear/home key will display the current line and return to select another edit mode at that point.
- ●The insert-line(s)-before-the-current-line feature allows adding new lines of source code before the current line, exactly as when creating a new source file. When clear/home is typed, the current line will be displayed and you can select another edit mode as desired.
- ●Copy-from-one-line-to-another-line copies selected lines to the new file without change while each line is dis-

Listing 1 continued.

```
300 REM ======================
310 GOSUB 2320:FL$=FL$+".SRC"
320 OPEN 2,8,2,DR$+":"+FL$+",S,W":GOSUB 2440:IF EN THEN 2210
330 GOSUB 2250
340 N=1
350 L$="":C$=L$:O$=L$:T$=O$:GOSUB 2470
360 REM ===========
370 REM LABEL FIELD
380 REM ===========
390 PRINT:PRINT"]";TAB(7);:C=1
400 GOSUB 2660:IF C=1 AND A=42 THEN 1090
410 IF A=32 THEN 600
420 S$=L$:IF (A>64) AND (A<91) THEN 550
430 IF (C>1) AND (A>47) AND (A<58) THEN 550
440 IF A=160 OR B=17 THEN 390
450 IF B=13 OR B=19 THEN 1370
460 IF A=157 THEN GOSUB 2710
470 IF A=29 THEN GOSUB 2690
480 T=6:IF A=20 THEN GOSUB 2730:GOTO 560
490 IF (A<>148) OR (LEN(L$)>5) THEN 400
500 GOSUB 2770
510 GOSUB 2660:IF A=141 OR B=19 THEN 1370
520 IF (A>64) AND (A<91) THEN 540
530 IF (C=1) OR (A<48) OR (A>59) THEN 510
540 GOSUB 2820:GOTO 560
550 IF C<7 THEN GOSUB 2540
560 L$=S$:GOTO 400
570 REM =============
580 REM COMMAND FIELD
590 REM =============
600 PRINT TAB(15);:C=1
610 GOSUB 2660:IF A=32 THEN 750
620 S$=C$:IF (A>32) AND (A<96) AND (C<6) THEN GOSUB 2540:GOTO 710
630 IF (B=17) OR (C=1 AND A=160) THEN 390
640 IF A=160 THEN PRINT:PRINT "]";:GOTO 110
650 IF B=13 OR B=19 THEN 1370
660 IF A=157 THEN GOSUB 2710
670 IF A=29 THEN GOSUB 2690
680 T=14:IF A=20 THEN GOSUB 2730:GOTO 710
690 IF (A<>148) OR (LEN(C$)>4) THEN 610
700 GOSUB 2790:IF A=141 OR B=19 THEN 1370
710 C$=S$:GOTO 610
720 REM ==============
730 REM OPERAND FIELD
740 REM ==============
750 PRINT TAB(23);:C=1
760 GOSUB 2660:IF A=32 THEN PRINT:PRINT:GOTO 910
770 S$=O$:IF (A>32) AND (A<96) AND (C<14) THEN GOSUB 2540:GOTO 870
780 IF C=1 AND A=160 THEN PRINT:PRINT"]";:GOTO 600
790 IF A=160 THEN PRINT:PRINT"]";:GOTO 750
800 IF B=17 THEN 390
810 IF B=13 OR B=19 THEN 1370
820 IF A=157 THEN GOSUB 2710
830 IF A=29 THEN GOSUB 2690
840 T=22:IF A=20 THEN GOSUB 2730:GOTO 870
850 IF (A<>148) OR (LEN(O$)>12) THEN 760
860 GOSUB 2790:IF A=141 OR B=19 THEN 1370
870 O$=S$:GOTO 760
880 REM =============
890 REM COMMENT FIELD
900 REM =============
910 PRINT TAB(7);:C=1
920 GOSUB 2660:IF C=1 AND A=160 THEN PRINT:PRINT"]]]";:GOTO 750
930 IF A=160 THEN PRINT:PRINT"]";:GOTO 910
940 S$=T$:IF (B>31) AND (B<96) AND (C<26) THEN GOSUB 2540:GOTO 1050
950 IF B=17 THEN PRINT"]]";:GOTO 390
960 IF B=13 OR B=19 THEN 1380
970 IF A=157 THEN GOSUB 2710
980 IF A=29 THEN GOSUB 2690
990 T=6:IF A=20 THEN GOSUB 2730:GOTO 1050
1000 IF (A<>148) OR (LEN(T$)>24) THEN 920
1010 GOSUB 2770
1020 GOSUB 2660:IF A=141 OR B=19 THEN 1380
1030 IF (B<32) OR (B>95) THEN 1020
1040 GOSUB 2820
1050 T$=S$:GOTO 920
1060 REM =================
1070 REM FULL LINE COMMENT
1080 REM =================
1090 IF L$+C$+O$+T$<>"" THEN 400
1100 L$=R$:PRINT R$;
1110 PRINT TAB(9);:C=1
1120 GOSUB 2660:S$=T$:IF ((B>32) AND (B<96)) OR A=32 THEN 1330
1130 IF B=13 OR B=19 THEN 1370
1140 IF A<>157 THEN 1170
1150 IF C=32 THEN PRINT:PRINT"]]]]":PRINT TAB(39);:C=C-1:GOTO 1120
1160 GOSUB 2710:GOTO 1120
1170 IF A=29 AND C<LEN(T$)+1 THEN GOSUB 2700:GOTO 1350
1180 IF A<>160 AND B<>17 THEN 1210
1190 PRINT:PRINT"]";:IF C>30 THEN PRINT"]]";
1200 GOTO 1110
1210 IF (A<>148) OR (LEN(T$)>49) THEN 1280
1220 IF C>31 THEN PRINT " ";MID$(T$,C):PRINT "]";TAB(C-23);:GOTO 1250
1230 PRINT " ";MID$(T$,C,31-C);TAB(70);" ":PRINT TAB(9);MID$(T$,31)
1240 PRINT"]]]";TAB(8+C);
1250 GOSUB 2660:IF A=141 OR B=19 THEN 1370
1260 IF (B<32) OR (B>95) THEN 1250
1270 S$=T$:GOSUB 2750:W$=MID$(T$,C):T$=S$+W$:GOSUB 2700:GOTO 1120
1280 IF (A<>20) OR (C>LEN(T$)) THEN 1120
1290 IF C>31 THEN PRINT MID$(T$,C+1);" ":PRINT "]";TAB(C-23);:GOTO 1320
1300 PRINT MID$(T$,C+1,32-C);" ";TAB(70);" ":PRINT TAB(9);MID$(T$,33);" "
1310 PRINT "]]]";SPC(8+C);
```

More

played and possibly printed. If no number is entered and return is pressed, only the current line will be copied. By entering the keyword END, the input file will be copied to the end of the file.

- The delete-from-one-line-to-another-line mode is similar to the copy mode except it deletes the lines and displays the remaining lines.

Copying Source Files

This function of the Editor copies existing source files unchanged. Each line is displayed, and possibly printed. Multiple files can be copied and concatenated into one new source file. At the end of each file copied, the total number of lines in the new file will be displayed.

Reading and Printing Source Files

This function reads an existing source file and displays and/or prints each line as it is read. Hitting any key on the keyboard except clear/home or run/stop will alternately stop and start the function to let you hold various sections for closer examination. Hitting clear/home will terminate the function and return to the function menu after closing the input file. If you are not using a Commodore printer you may have to modify the print routines for them to function properly. If a printer is not used, just answer N for no when asked for a print option at the start of the Editor. In this way, all printing will be bypassed automatically.

Printing Saved Listing Files

This function simply prints the saved listing file on the printer as read from the disk file.

Assembler

The Assembler program (Listing 2) is a simple two-pass assembler that reads the source files generated by the Editor program and generates a standard PET program file on disk. It also provides a printed assembly listing complete with a symbol table that can optionally be saved onto disk for documentation purposes and so on.

On the first pass, the Assembler builds the symbol table while defining each label and computing its value. The symbols are displayed as they are defined to give you feedback on how the first pass is progressing. The symbol table is currently limited to 100 symbols. This limit may be changed by modifying the value of SZ in line 100. If the symbol table limit is reached, or the amount of free memory space is less than 100 bytes, an error message will be displayed and the first pass will be ended.

If any I/O errors are encountered while reading the input files, an error message is displayed indicating the status code (ST) and/or disk error. Assembly will be terminated after reporting any fatal error of this type.

During the second pass, the source file is read again while the program file is written to disk. An assembly-language listing may also be printed or can be written to disk. The program file produced can then be loaded into the PET like any other program, since it uses the standard PET file formats. However, because of this, the program must be one contiguous block without any *holes*.

The printed listing produced by the Assembler will indicate the memory location and object in hexadecimal, the source file line number and the original line of source code consisting of label, command, operand and comment. The line number corresponds directly with the line numbers displayed by the Editor when editing the source file. Therefore, these numbers can be used to readily locate specific lines when editing from printed assembly or source file listings.

The Assembler expects the format of each line of code in the source file to contain four fields: an optional label, a mandatory command, an optional operand and a comment. Alternately, a line may be a full-line comment if the first character of the line is an asterisk.

Labels can be one to six characters in length. The first character must be a letter while any remaining characters may be letters or numbers. The value of any label will be the address of the next byte of memory defined by the command or the value assigned to the label via an Assembler directive. All label values are computed as unsigned 16-bit values and maintained as such within the symbol table. If any label is multiply defined, the first definition will be used and all duplicate definitions will be indicated in the symbol table. These errors will also be included in the error count shown at the end of the assembly.

The command will consist of either an instruction mnemonic followed by the appropriate addressing suffix or one of the available Assembler directives. Instruction mnemonics are the standard mnemonics used by MOS Technology. To speed assembly

Listing 1 continued.

```
1320 S$=T$:R$=MID$(T$,C+1):GOSUB 2750:T$=S$:GOTO 1120
1330 IF C>50 THEN 1120
1340 GOSUB 2540
1350 IF C=32 THEN PRINT:PRINT SPC(9);
1360 T$=S$:GOTO 1120
1370 IF C<32 THEN PRINT:PRINT
1380 PRINT:PRINT:IF A=141 OR B=19 THEN 1410
1390 IF L$="*" OR C$<>"" THEN GOSUB 2380:GOSUB 2420:GOTO 1450
1400 PRINT"TTTT";:GOTO 390
1410 PRINT"TTTD>>>▓▓▓":IF B<>19 THEN 1450
1420 IF M THEN 1610
1430 C$=".END":L$="":O$=L$:T$=O$:GOSUB 2430:IF M=0 THEN GOSUB 2680
1440 GOTO 2210
1450 IF M<>1 THEN 1490
1460 GOSUB 2560:IF E THEN 1770
1470 GOSUB 2500:PRINT"TTTT";:IF L$="*" THEN 1110
1480 GOTO 390
1490 IF A<>141 THEN N=N+1
1500 GOTO 350
1510 REM =========
1520 REM EDIT FILE
1530 REM =========
1540 GOSUB 2320:E=0
1550 PRINT#15,"S"+DR$+":"+FL$+".BAK":INPUT#15,EN
1560 PRINT#15,"R"+DR$+":"+FL$+".BAK="+DR$+":"+FL$+".SRC"
1570 GOSUB 2440:IF EN THEN 2210
1580 OPEN 1,8,2,DR$+":"+FL$+".BAK,S,R":GOSUB 2440:IF EN THEN 2210
1590 OPEN 2,8,3,DR$+":"+FL$+".SRC,S,W":GOSUB 2440:IF EN THEN 2210
1600 GOSUB 2560:IF E THEN 1770
1610 M=0:GOSUB 2250:GOSUB 2490:PRINT U$:PRINT"   1 - EDIT LINE BY LINE":PRINT
1620 PRINT"   2 - INSERT LINE(S) BEFORE THIS LINE":PRINT
1630 PRINT"   3 - COPY FROM THIS LINE TO LINE#":PRINT
1640 PRINT"   4 - DELETE FROM THIS LINE TO LINE#":PRINT U$
1650 PRINT"SELECT DESIRED EDITING MODE: ";
1660 GOSUB 2610:M=V:IF V<1 OR V>4 THEN 1660
1670 GOSUB 2250:ON M GOTO 1470,340
1680 GOSUB 2500:PRINT U$:IF M=3 THEN PRINT"COPY";
1690 IF M=4 THEN PRINT"DELETE";
1700 PRINT" FROM THIS LINE TO .....▓":PRINT"(END = END OF INPUT FILE)":PRINT
1710 PRINT"LINE#  ";N:PRINT"]";SPC(6);
1720 INPUT R$:L=VAL(R$):IF R$="END" THEN L=1E5
1730 GOSUB 2250:IF L<N THEN 1680
1740 IF M=3 THEN PRINT"COPY";
1750 IF M=4 THEN PRINT"DELET";
1760 PRINT"ING LINE(S) .....":PRINT:PRINT:GOTO 1880
1770 GOSUB 2250:PRINT"END OF ORIGINAL INPUT FILE":GOSUB 2680
1780 PRINT"WANT TO ADD ADDITIONAL LINES";
1790 GOSUB 2630:M=0:IF A=78 THEN M=2:GOTO 1430
1800 N=Z+1:GOSUB 2250:GOTO 350
1810 PRINT:INPUT"NEW OUTPUT MODULE NAME   ▄███";FL$:IF FL$="■" THEN 1810
1820 GOSUB 2350:OPEN 2,8,3,DR$+":"+FL$+".SRC,S,W":GOSUB 2440:IF EN THEN 2210
1830 GOSUB 2250:E=0:N=0
1840 PRINT:INPUT"INPUT MODULE NAME   ▄███";FL$:IF FL$="■" THEN 1840
1850 GOSUB 2350:OPEN 1,8,2,DR$+":"+FL$+".SRC,S,R":GOSUB 2440:IF EN THEN 2210
1860 GOSUB 2250:PRINT"COPYING FILE.....":PRINT:PRINT
1870 GOSUB 2560:IF E THEN 1910
1880 IF M<4 THEN GOSUB 2380:GOSUB 2420
1890 IF M AND (N=L) THEN 1600
1900 GOTO 1870
1910 IF M THEN 1770
1920 CLOSE 1:GOSUB 2440:IF EN THEN 2210
1930 GOSUB 2680:PRINT"COPY ANOTHER FILE";
1940 GOSUB 2630:IF A=78 THEN GOSUB 2420:GOTO 2210
1950 GOTO 1830
1960 REM ===================
1970 REM PRINT LISTING FILE
1980 REM ===================
1990 GOSUB 2320:FL$=FL$+".LST"
2000 OPEN 1,8,4,DR$+":"+FL$+",S,R":GOSUB 2440:IF EN THEN 2210
2010 GOSUB 2250:PRINT:PRINT"PRINTING FILE.....":PRINT
2020 INPUT#1,L$:GOSUB 2440:IF EN>0 OR L$=".END" THEN 2210
2030 IF LEFT$(L$,1)="." THEN L$=" "+MID$(L$,2)
2040 PRINT#4,L$:GOTO 2020
2050 REM =========
2060 REM READ FILE
2070 REM =========
2080 GOSUB 2320:FL$=FL$+".SRC"
2090 E=0:OPEN 1,8,2,DR$+":"+FL$+",S,R":GOSUB 2440:IF EN THEN 2210
2100 GOSUB 2250:IF F=5 THEN PRINT:PRINT"PRINTING FILE.....":PRINT
2110 GOSUB 2570:IF E THEN 2170
2120 IF F=4 THEN GOSUB 2500
2130 GOSUB 2380:GET R$:IF R$="" THEN 2110
2140 IF (ASC(R$) AND 127)=19 THEN PRINT U$:GOTO 2210
2150 GOSUB 2600:IF F=5 THEN 2100
2160 GOTO 2110
2170 IF F=4 THEN GOSUB 2600
2180 REM ==========================
2190 REM CLOSE ALL FILES AND RESTART
2200 REM ==========================
2210 CLOSE 1:CLOSE 2:CLOSE 4:CLOSE 15:GOTO 80
2220 REM ==========================
2230 REM ******* SUBROUTINES *******
2240 REM ==========================
2250 PRINT"]";Q$(F);:IF M=0 THEN PRINT:GOTO 2300
2260 PRINT"  -  ";:IF M=1 THEN PRINT"LINE BY LINE"
2270 IF M=2 THEN PRINT"INSERT"
2280 IF M=3 THEN PRINT"COPY"
2290 IF M=4 THEN PRINT"DELETE"
2300 PRINT U$:RETURN
2310 P=1:OPEN 4,4:RETURN
2320 PRINT:INPUT"MODULE NAME   ▄███";FL$
2330 IF FL$="■" THEN 2320
```

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Listing 1 continued.

```
2340 FL$=LEFT$(FL$,12)
2350 PRINT:PRINT"DRIVE# 0 OR 1: ";
2360 GET DR$:IF DR$<>"0" AND DR$<>"1" THEN 2360
2370 PRINT DR$:RETURN
2380 IF P=0 THEN RETURN
2390 PRINT#4,SPC(6-LEN(STR$(N)));N;SPC(2);
2400 IF L$="*" THEN PRINT#4,"* ";T$:RETURN
2410 PRINT#4,L$;SPC(8-LEN(L$));C$;SPC(7-LEN(C$));O$;SPC(15-LEN(O$));T$:RETURN
2420 Z=Z+1
2430 PRINT#2,L$;",";C$;",";O$;",";T$;CR$;
2440 INPUT#15,EN$,EM$,ET$,ES$:EN=VAL(EN$):IF EN=0 THEN RETURN
2450 GOSUB 2250:PRINT"▒DISK ERROR!■▒":PRINT EN$;" ";EM$,ET$;" ";ES$
2460 PRINT:PRINT:GOTO 2600
2470 V=4:IF M=2 THEN PRINT"▒▒";:V=3
2480 PRINT RIGHT$("    "+STR$(N),V);"■>";:RETURN
2490 L$=L1$:C$=C1$:O$=O1$:T$=T1$:N=N1
2500 GOSUB 2470:PRINT TAB(7);L$;
2510 IF L$<>"*" THEN 2530
2520 PRINT" ";LEFT$(T$,31);TAB(50);" ":PRINT TAB(9);MID$(T$,32):PRINT:RETURN
2530 PRINT TAB(15);C$;TAB(23);O$:PRINT:PRINT TAB(7);T$:PRINT:RETURN
2540 IF C>LEN(S$) THEN S$=S$+R$:GOTO 2700
2550 W$=MID$(S$,C+1):GOSUB 2750:S$=S$+W$:GOTO 2700
2560 GOSUB 2570:N1=N:L1$=L$:C1$=C$:O1$=O$:T1$=T$:RETURN
2570 INPUT#1,L$,C$,O$,T$:GOSUB 2440
2580 IF C$=".END" THEN E=1 RETURN
2590 N=N+1:RETURN
2600 PRINT"▒        DEPRESS ANY KEY TO CONTINUE      "
2610 GET R$:IF R$="" THEN 2610
2620 V=VAL(R$):A=ASC(R$):B=(A AND 127):RETURN
2630 PRINT" (Y/N): ";
2640 GOSUB 2610:IF A<>89 AND A<>78 THEN 2640
2650 PRINT R$:PRINT U$:RETURN
2660 PRINT"▒▮▮";:GOSUB 2610:PRINT" ▮⌉";:IF A=34 OR A=44 OR A=58 THEN 2660
2670 RETURN
2680 PRINT:PRINT"NEW FILE =";Z;"LINES":PRINT U$:FETURN
2690 IF C>LEN(S$) THEN RETURN
2700 C=C+1:PRINT R$;:RETURN
2710 IF C>1 THEN C=C-1:PRINT R$;
2720 RETURN
2730 IF C>LEN(S$) THEN RETURN
2740 R$=MID$(S$,C+1):PRINT R$;" ":PRINT"⌉";TAB(T+C);
2750 IF C>1 THEN S$=LEFT$(S$,C-1)+R$:RETURN
2760 S$=R$:RETURN
2770 W$=MID$(S$,C):PRINT" ";W$,
2780 PRINT:PRINT"⌉";TAB(T+C);:RETURN
2790 GOSUB 2770
2800 GOSUB 2660:IF A=141 OR B=19 THEN RETURN
2810 IF (A<33) OR (A>95) THEN 2800
2820 GOSUB 2750:S$=S$+W$:GOTO 2700
```

Listing 2. DASM-Assembler in PET BASIC.

```
10 REM ***** DASM - ASSEMBLER *******
20 REM *                            *
30 REM *      BY:   ROBERT BAKER    *
40 REM *                            *
50 REM ****  V3.0  **** 08/01/81 ****
60 :
70 :
80 PRINT"⌉"SPC(6)"▒D A S M   A S S E M B L E R"PRINT:PRINT:PRINT
90 CLR:CR$=CHR$(13)
100 SZ=100:DIM S$(SZ),V(SZ)
110 PRINT:INPUT"MODULE NAME   ▄■■▌";FL$
120 IF FL$="▄" THEN 110
130 PRINT:PRINT"DRIVE# 0 OR 1: ";
140 GET DR$:IF DR$<>"0" AND DR$<>"1" THEN 140
150 PRINT DR$:FL$=LEFT$(FL$,12):OPEN 15,8,15
160 PRINT#15,"S"+":"+FL$:INPUT#15,EN
170 GOSUB 1490
180 OPEN 2,8,3,DR$+":"+FL$+",P,W":GOSUB 1510
190 PRINT:PRINT"LISTING TO DISK (D) OR PRINTER (P): ";
200 GET PR$:IF PR$<>"D" AND PR$<>"P" THEN 200
210 PRINT PR$:IF PR$="P" THEN OPEN4,4:LE$=CHR$(13)+CHR$(10):LS$=" ":GOTO 270
220 PRINT#15,"S"+DR$+":"+FL$+".LST":INPUT#15,EN
230 OPEN 4,8,4,DR$+":"+FL$+".LST,S,W":GOSUB 1510:LE$=CHR$(13):LS$="."
240 REM ================================
250 REM FIRST PASS, GENERATE SYMBOL TABLE
260 REM ================================
270 PRINT"⌉FIRST PASS - DEFINING SYMBOLS":PRINT:PRINT
280 GOSUB 1500:IF L$<"A" THEN 350
290 PRINT L$,
300 IF S=SZ OR FRE(0)<100 THEN PRINT"▒SYMBOL TABLE OVERFLOW":GOTO 440
310 S=S+1:S$(S)=L$:IF C$<>"=" THEN 340
320 GOSUB 1160:V(S)=N:IF N<0 THEN S=S-1
330 GOTO 280
340 V(S)=P
350 IF C$>"@" THEN GOSUB 1100:GOTO 280
360 IF C$<>"*=" THEN 410
370 IF P>0 THEN 280
380 GOSUB 1160:IF N > -1 THEN P=N
390 IF L$<>"" THEN V(S)=P
400 GOTO 280
410 IF C$=".BY" THEN P=P+1
420 IF C$=".ADR" THEN P=P+2
430 IF C$<>".END" THEN 280
440 CLOSE 1:GOSUB 1510:GOSUB 1490
450 REM ============================
```

More →

times, an addressing suffix is added to the mnemonic rather than being encoded into the operand. The following table lists the suffixes used for each addressing mode:

blank	Absolute, implied or relative
A	Accumulator
#	Immediate
@	Indirect
Z	Zero page
X	Absolute indexed—register X
Y	Absolute indexed—register Y
@X	Indexed indirect—register X
@Y	Indirect indexed—register Y
ZX	Zero page indexed—register X
ZY	Zero page indexed—register Y

Only four Assembler directives are available—mainly to keep the assembly times as short as possible. The functions include:

- .ADR *n*, which defines a two-byte address constant in standard address format; low-order eight bits, high-order eight bits.
- .BY *n*, which defines a one-byte constant of the value *n*. If *n* is greater than 255, then the byte will be the low-order eight bits (one byte) of the binary value specified.
- LABEL = *n*, which defines a symbolic label with the value *n*. A label must be specified and the value *n* must be previously defined in the first pass of the assembly.
- * = *n*, which sets the program counter to the value specified, as a 16-bit quantity. If a label is specified, it will be assigned the same value as *n*, the first byte of the new area of memory. The value of *n* must be previously defined in the first pass. This command must be used prior to assembling any actual instructions, if it is to be used at all. This is because the program file being produced must be a contiguous block of code with a known starting address. The default address is zero if none is specified.

Instruction and Assembler directive operands may be specified in a number of formats, shown in Table 1. In addition, three operators are allowed within simple expressions using any of the above formats (decimal, hexadecimal, etc.) for each value in the expressions shown in Table 2.

All operands are computed as 16-bit quantities. If a command only requires an eight-bit quantity (such as a load accumulator immediate instruction), only the low order eight bits of the operand value will be used.

Comments in an instruction line may be up to 25 characters long, and

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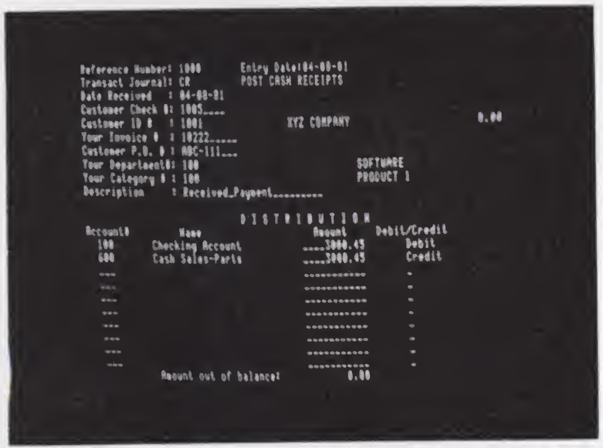

```
Reference Number: 1000      Entry Date:04-08-81
Transact Journal: CR        POST CASH RECEIPTS
Date Received   : 04-08-81
Customer Check #: 1005____
Customer ID #   : 1001              XYZ COMPANY                  0.00
Your Invoice #  : 10222_____
Customer P.O. # : ABC-111___
Your Department#: 100                      SOFTWARE
Your Category # : 100                      PRODUCT 1
Description     : Received_Payment_________

                     D I S T R I B U T I O N
 Account#        Name                    Amount      Debit/Credit
   100     Checking Account          ____3000.45        Debit
   600     Cash Sales-Parts          ____3000.45        Credit
   ----                              -----------          -
   ----                              -----------          -
   ----                              -----------          -
   ----                              -----------          -
   ----                              -----------          -
   ----                              -----------          -
   ----                              -----------          -
   ----                              -----------          -
            Amount out of balance:          0.00
```

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Listing 2 continued.

```
460 REM SECOND PASS, GENERATE OBJECT
470 REM ============================
480 PRINT"⊐SECOND PASS - LISTING/OBJECT"
490 L=0:PS=0:P=0:EN=0:M$="....."
500 PRINT#4,"LOC   -OBJECT-  LINE  ";M$;M$;
510 PRINT#4," SOURCE CODE ";M$;M$;M$;" < DASM V3.0 >";LE$;
520 PRINT#4,LS$;"  ";LE$;
530 E=0:B$="":GOSUB 1500:L=L+1:N$=STR$(L):IF L$="" THEN 560
540 IF L$="*" THEN PRINT#4,LS$;SPC(19-LEN(N$));N$;"  * ";T$;LE$;:GOTO 530
550 IF C$  = "=" THEN 890
560 IF C$  > "@" THEN 670
570 IF C$ <> "*=" THEN 630
580 IF PF>0 THEN E=E+4:GOTO 900
590 GOSUB 1160:IF N<0 THEN E=E+2: GOTO 900
600 P=N:PS=P
610 GOSUB 620:GOTO 770
620 P1=INT(PS/256):PRINT#2,CHR$(PS-(P1*256));CHR$(P1);:PF=1:RETURN
630 PS=P:PB=3:IF C$= ".BY" THEN P=P+1:GOTO 730: REM <== 1-BYTE CONSTANT
640 IF C$ = ".ADR" THEN P=P+2: GOTO 730: REM <== 2-BYTE ADR CONSTANT
650 IF C$ = ".END" THEN 940
660 E=E+4: GOTO 900
670 PB=0:GOSUB 1100:I$=MID$(I$,5):IF PB=0 THEN E=E+4:GOTO 900
680 A$=LEFT$(A$+"  ",2)
690 IF LEFT$(I$,2)=A$ THEN 720
700 I$=MID$(I$,6):IF I$>"" THEN 690
710 E=E+8:X1=PS:GOTO 1450
720 N=VAL(MID$(I$,3,3)):GOSUB 1420:GOSUB 1460:B$=H2$+" ":IF PB=1 THEN 770
730 GOSUB 1160:IF N<0 THEN E=E+2:GOTO 1440
740 IF PB=2 THEN N=N-P:IF N>127 OR N < -128 THEN E=E+16:GOTO 1440
750 N1=INT(N/256):N2=N-(N1*256):GOSUB 1460:N=N2:GOSUB 1420:B$=B$+H2$+" "
760 IF P-PS=3 OR C$= ".ADR" THEN N=N1:GOSUB 1420:B$=B$+H1$
770 N=PS:GOSUB 1460:PRINT#4,H$;
780 PRINT#4,"  ";B$;SPC(14-LEN(B$)-LEN(N$));N$;"  ";L$;SPC(8-LEN(L$));C$;
790 PRINT#4,SPC(7-LEN(C$));O$;SPC(15-LEN(O$));T$;LE$;:IF E=0 THEN 530
800 REM ======================
810 REM FLAG ERRORS IN LISTING
820 REM ======================
830 PRINT#4,"****  INVALID...";SPC(14);
840 IF (E AND 2) THEN PRINT#4,SPC(7);"└ OPERAND";LE$;
850 IF (E AND 4) THEN PRINT#4,"└ COMMAND";LE$;
860 IF (E AND 8) THEN PRINT#4,SPC(3);"└ ADR'NG MODE";LE$;
870 IF (E AND 16) THEN PRINT#4,SPC(7);"└ BRANCH";LE$;
880 EN=EN+1:GOTO 530
890 GOSUB 1160:IF N<0 THEN E=E+2
900 PRINT#4,LS$;SPC(3);:GOTO 780
910 REM ================================
920 REM PRINT SYMBOL TABLE & ERROR SUMMARY
930 REM ================================
940 IF S=0 THEN 1040
950 FOR X=1 TO 5:PRINT#4,LS$;"  ";LE$;:NEXT
960 PRINT#4,"SYMBOL     HEX--VALUE--DECIMAL";LE$;:PRINT#4,LS$"  ";LE$;
970 B$="":S$(0)="←":FOR E=1 TO S:P=0:FOR T=1 TO S:IF S$(T) < S$(P) THEN P=T
980 NEXT
990 IF B$<>S$(P) THEN 1010
1000 PRINT#4,"******   MULTIPLE DEFINITION";LE$;:EN=EN+1:GOTO 1030
1010 N=V(P):O$=STR$(N):GOSUB 1460:B$=S$(P)
1020 PRINT#4,B$;SPC(11-LEN(B$));H$;SPC(14-LEN(O$));O$;LE$;
1030 S$(P)="←":NEXT
1040 PRINT#4,LS$"  ";LE$;:PRINT#4,EN;" ERRORS";LE$;
1050 IF PR$="D" THEN PRINT#4,".END";LE$;
1060 PRINT"⊐ASSEMBLY COMPLETE, ";EN;"ERRORS":GOTO 1550
1070 REM ============================
1080 REM ***** NESTED SUBROUTINES *****
1090 REM ============================
1100 M$=LEFT$(C$,3):A$=MID$(C$,4)
1110 RESTORE:FOR N=1 TO 56:READ I$:IF M$<>LEFT$(I$,3) THEN NEXT:RETURN
1120 PS=P:PB=VAL(MID$(I$,4,1)):IF A$="" THEN P=P+PB:RETURN
1130 P=P+2:IF A$="X" OR A$="Y" THEN P=P+1:RETURN
1140 IF A$="A" THEN P=P-1:PB=1
1150 RETURN
1160 M$=O$:FOR X=1 TO LEN(O$):I$=MID$(O$,X,1)
1170 IF I$="+" OR I$="-" OR I$="/" THEN 1190
1180 NEXT:GOSUB 1300:RETURN
1190 N=0:A$=MID$(M$,X+1)
1200 IF X>1 THEN O$=LEFT$(M$,X-1):GOSUB 1300:IF N<0 THEN 1290
1210 N1=N:O$=A$:GOSUB 1300:IF N<0 THEN 1290
1220 O$=M$:IF I$= "+" THEN N2=N+N1
1230 IF I$= "-" THEN N2=N1-N
1240 IF I$= "/" THEN N2=INT(N1/N):IF LEFT$(M$,1)="/" THEN 1290
1250 N=N2
1260 IF N<0 THEN N=N+65536:GOTO 1260
1270 IF N>65535 THEN N=N-65536:GOTO 1270
1280 RETURN
1290 O$=M$:GOTO 1370
1300 IF O$ < "A" THEN 1330
1310 FOR X=0 TO S:IF S$(X)=O$ THEN N=V(X):RETURN
1320 NEXT:GOTO 1370
1330 IF LEFT$(O$,1)<>"$" THEN 1380
1340 N=0:FOR X=2 TO 6:H$=MID$(O$,X,1):IF H$="" THEN RETURN
1350 X1=VAL(H$):IF X1 OR H$="0" THEN N=N*16+X1:NEXT
1360 X1=ASC(H$):IF X1>64 AND X1<71 THEN N=N*16+(X1-55):NEXT
1370 N=-1:RETURN
1380 N=INT(VAL(O$)):IF N OR O$="0" THEN RETURN
1390 IF O$="*" THEN N=P:RETURN
1400 IF LEFT$(O$,1)="'" AND LEN(O$)>1 THEN N=ASC(MID$(O$,2)):RETURN
1410 GOTO 1370
1420 IF PF=0 THEN GOSUB 620
1430 PRINT#2,CHR$(N);:RETURN
1440 IF C$>"@" THEN X1=PS+1
1450 N=0:FOR X=1 TO P-X1:B$=B$+"00 ":GOSUB 1420:NEXT:GOTO 770
1460 H$="":FOR X=3 TO 0 STEP-1:X1=INT(N/(16↑X)):N=N-(X1*(16↑X))
1470 IF X1>9 THEN X1=X1+7
```

More →

any characters can be used (except as limited by the Editor due to handling of BASIC files with INPUT#). A full-line comment can be up to 50 characters long. Comment fields can contain graphics characters if desired.

Any assembly errors will be indicated in the printed assembly listing with an error line indicating the field in error. At the end of the assembly, the total number of errors will be indicated. Also, a sorted symbol table will be at the end of the assembly listing indicating the defined value of each symbol in both hexadecimal and decimal form for your convenience.

Hints

The following are hints on effective use of the Editor/Assembler:

- Try to break up larger programs into smaller, logical pieces that can be assembled and tested separately. This allows quicker editing and assembling, when a program is repeatedly edited and assembled to correct bugs as they're detected.
- Define most commonly used symbols, constants and all working storage at the beginning of each program. Symbols and labels are entered into the symbol table in the order defined and searched sequentially in that same order for greatest assembler speed.
- Keep labels short to allow the maximum number of labels within the symbol table when writing larger programs.
- Watch the usage and length of comments as this can tremendously increase the read time of the source file during editing and assembling.
- Remember that line numbers in the printed assembly listing and source file listings correspond directly with the line numbers displayed by the editor when editing a source file. Therefore, they can be used to quickly locate a specific line when editing.
- The module name can be anything desired, with 12 characters maximum. A four-character suffix is automatically appended to identify the file type:

.SRC	Source file
.BAK	Backup source file automatically created when editing a source file
.LST	Listing file saved to disk

The name of the final program file generated by the assembler will be the module name with no suffix.

If you want to avoid typing in the two programs shown, I'll send a copy of both on a 4040 diskette (DOS 2.1) for $5 to cover my costs.■

Listing 2 continued.

```
1480 H$=H$+CHR$(X1+48):NEXT:H1$=LEFT$(H$,2):H2$=RIGHT$(H$,2):RETURN
1490 OPEN 1,8,2,DR$+":"+FL$+".SRC,S,R":GOTO 1510
1500 INPUT#1,L$,C$,O$,T$
1510 INPUT#15,EN$,EM$,ET$,ES$:IF EN$="00" THEN RETURN
1520 PRINT"■■DISK ERROR!":PRINT
1530 PRINT EN$;" ";EM$,ET$;" ";ES$
1540 PRINT:PRINT:PRINT"■ASSEMBLY ABORTED":PRINT:PRINT
1550 CLOSE 1:CLOSE 2:CLOSE 4:CLOSE 15:END
1560 REM ======================================
1570 REM ******* INSTRUCTION DATA TABLE ********
1580 REM ======================================
1590 REM CONTAINS 56 ENTRIES, 1 PER INSTRUCTION
1600 REM EACH ENTRY CONSISTS OF:
1610 REM           3 CHARACTER MNEMONIC
1620 REM           1 DIGIT INSTRUCTION LENGTH
1630 REM MULTIPLE 5 CHARACTER EXTENSIONS FOR EACH
1640 REM            VALID ADDRESSING MODE-
1650 REM             2 CHARACTER MNEMONIC SUFFIX
1660 REM             3 DIGIT OPCODE VALUE
1670 REM A NULL ENTRY IS INCLUDED AT THE END OF
1680 REM THE TABLE.
1690 REM ======================================
1700 DATA "ADC3# 105  109Z 101@X097@Y113ZX117X 125Y 121"
1710 DATA "AND3# 041  045Z 037@X033@Y049ZX053X 061Y 057"
1720 DATA "ASL3  014Z 006A 010ZX022X 030","BCC2  144","BCS2  176"
1730 DATA "BEQ2  240","BIT3  044Z 036","BMI2  048","BNE2  208","BPL2  016"
1740 DATA "BRK1  000","BVC2  080","BVS2  112","CLC1  024","CLD1  216"
1750 DATA "CLI1  088","CLV1  184"
1760 DATA "CMP3# 201  205Z 197@X193@Y209ZX213X 221Y 217"
1770 DATA "CPX3# 224  236Z 228","CPY3# 192  204Z 196"
1780 DATA "DEC3  206Z 198ZX214X 222","DEX1  202","DEY1  136"
1790 DATA "EOR3#073  077Z 069@X065@Y081ZX085X 093Y 089"
1800 DATA "INC3  238Z 230ZX246X 254","INX1  232","INY1  200"
1810 DATA "JMP3  076@ 108","JSR3  032"
1820 DATA "LDA3# 169  173Z 165@X161@Y177ZX181X 189Y 185"
1830 DATA "LDX3# 162  174Z 166Y 190ZY182","LDY3# 160  172Z 164ZX180X 188"
1840 DATA "LSR3  078Z 070A 074ZX086X 094","NOP1  234"
1850 DATA "ORA3# 009  013Z 005@X001@Y017ZX021X 029Y 025","PHA1  072"
1860 DATA "PHP1  008","PLA1  104","PLP1  040","ROL3  046Z 038A 042ZX054X 062"
1870 DATA "ROR3  110Z 102A 106ZX118X 126","RTI1  064","RTS1  096"
1880 DATA "SBC3# 233  237A 229@X225@Y241ZX245X 253Y 249","SEC1  056"
1890 DATA "SED1  248","SEI1  120","STA3  141Z 133@X129@Y145ZX149X 157Y 153"
1900 DATA "STX3  142Z 134ZY150","STY3  140Z 132ZX148","TAX1  170"
1910 DATA "TAY1  168","TSX1  186","TXA1  138","TXS1  154","TYA1  152",""
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DEC ½ x 60YD.	3/pk	20.12/3 pk	14 25/3 pk (4 75 ea)	1 2'' x 180'	Double Spools	R-644
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IBM -"SILVER DOLLAR" Sys. 34, Sys. 32 MDLA, Series IMDL4974, 5256, 3287, 3770, 3771-3774, 4974, 5100, 5103, 5110, 5228, 5256, 5320MDLA	5/pk	5 80 ea	14 90/5 pk (2 98 ea)	9 16'' x 30'	Nylon Jet Blk	R-300
IBM - HARMONICA ½'' SERIES I. MOD 4973/II, 3200, 3289, MOD 2.	3/pk	9 42 ea	20 85/3 pk (6 95 ea)	1 2' x 108'	Nylon Jet Blk	C-350
NEC SPINWRITER	4/pk	23 40/3 cart	23 60/4 pk rb reload (5.90 ea)	1 2'' x 51'	Nylon/Ex Lng Life	R-400
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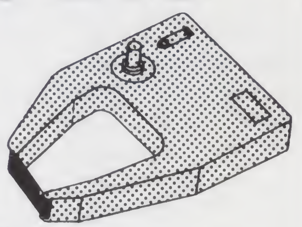

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After making a ten-wire cable, you can interface the Quik Printer II to the PET 2001 using this short program that resides in the second cassette buffer.

TRS-80 Printer for the PET

By Joseph W. Verzino

The strongest feature of my TRS-80 system was its Quik Printer II. So when I sold the TRS-80 in favor of my PET 2001, I decided to keep the printer and interface it to the PET. Others might want to do the same, since the Quik Printer II is inexpensive—only $187.

I chose to use the parallel (user) port, because it is the simplest. I rejected the IEEE-488 port because it requires opening and closing files, and because the IEEE-488 commands complicate the problem. And most people are probably already using their memory expansion port.

First, I added a reset button. Programs in the second cassette buffer (033A–3FF hexadecimal, 826–1023 decimal) are retained when the reset button is activated, so I placed the Print Screen program there. BASIC programs reside in higher memory starting at 0400 (hexadecimal), and are erased on reset. A BASIC program and this Print Screen program can reside in memory concurrently.

I tried to use handshaking on the CA1 line, but I couldn't get a response from the busy line of the printer. Consequently, I had to do data rate matching on the CB2 strobe line and operate without handshaking. However, operation without handshaking has proven to be reliable.

To copy a program, you must list it on the screen about 22 lines at a time and type SYS (826) in the command mode. The Print Screen program will change each 40-character line into two 20-character lines, since the Quik Printer II only prints 32 characters per line.

The assembly listing of Print Screen (Listing 1) was obtained in this way. I first listed lines 826 through 870 on the screen, then used SYS(826) to have those lines printed out. This process was repeated for lines 872 through 907, 912 through 945 and 947 through 995. The program was being used to produce an assembly listing of itself. (Notice the change from one 40-character line to two 20-character lines for each line of the program.)

The Print Screen Program

I used the TIM monitor to display a hex dump of part of the Print Screen program (i.e., a hexadecimal listing of the contents of memory locations 0338 to 03E0). I then used the Print Screen program to list the hex dump on the Quik Printer II (see Listing 2). You can use the TIM monitor and load the Print Screen program by entering the hexadecimal values in Listing 2.

I used a program from *Micro* magazine ("A Simple 6502 Assembler for the PET" by Michael J. McCann, Aug.–Sept. 1978) to produce the assembled version of the Print Screen program, but I actually wrote the program directly in machine language. The assembled version is shown in Listing 1.

I used the PET 6522 versatile interface adapter (VIA), located from E840 (59456) to E84F (59471), to communicate with the Quik Printer. Output register A without handshaking, located at E84F (59471), contains the output logic. The peripheral-control register (PCR) at E84C (59468) gener-

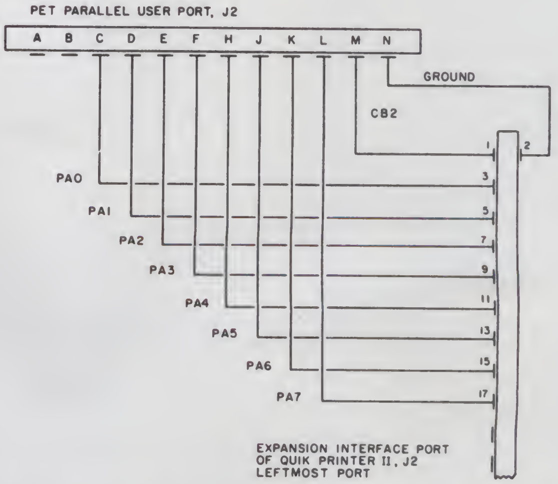
PET PARALLEL USER PORT, J2
A
B
C
D
E
F
H
J
K
L
M
N
GROUND
CB2
1
2
PA0
3
PA1
5
PA2
7
PA3
9
PA4
11
PA5
13
PA6
15
PA7
17
EXPANSION INTERFACE PORT OF QUIK PRINTER II, J2 LEFTMOST PORT

Fig. 1. Diagram of the ten connections that must be made from the parallel port of the PET to the expansion interface port of the Quik Printer II.

Address correspondence to Joseph W. Verzino, PO Box 265, DeWitt, NY 13214.

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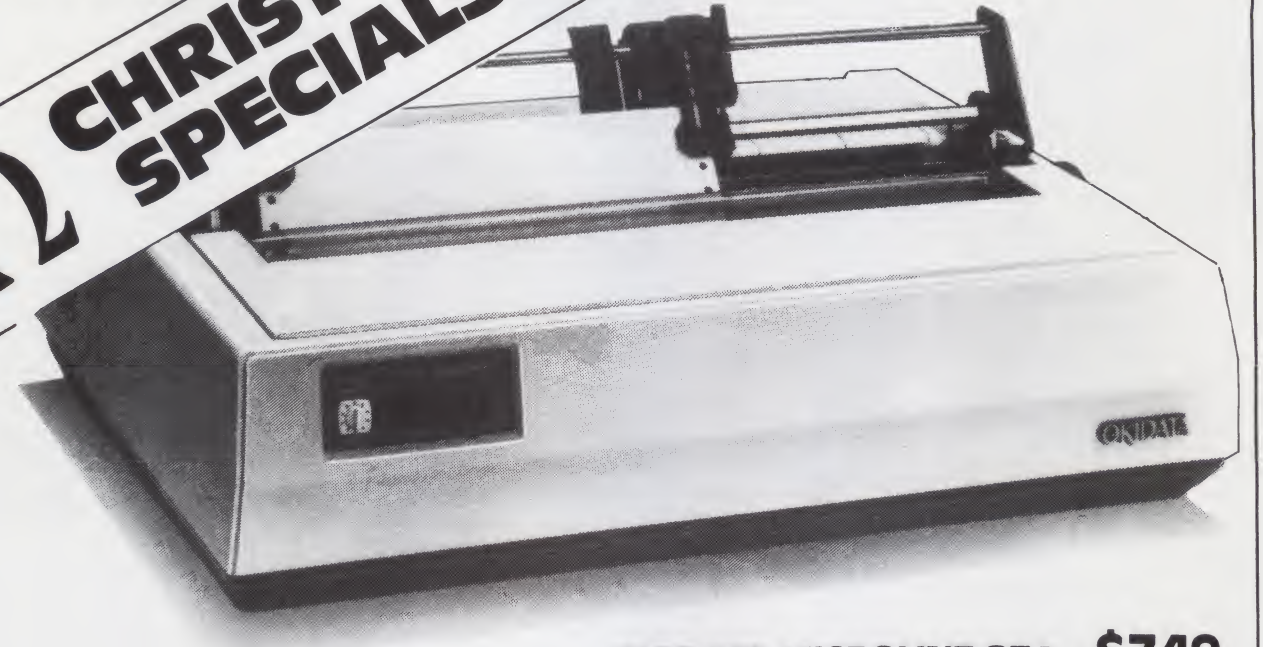

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Listing 1. Assembly-language listing of the Print Screen program. This listing was produced by using the Print Screen program on itself. Notice that it changes 40-character lines to two 20-character lines.

```
826 033A   A9 FF
LDAIM  255
828 033C   8D 43E8
STA    59459
831 033F   A0 00
LDYIM  0
833 0341   AD 4CE8
LDA    59468
836 0344   09 E0
ORAIM  224
838 0346   8D 4CE8
STA    59468
841 0349   20 B103
JSR    945
844 034C   A2 00
LDXIM  0
846 034E   B9 0080
LDAY   32768
849 0351   20 7C03
JSR    892
852 0354   20 D003
JSR    976
855 0357   C8
INY
856 0358   98
TYA
857 0359   C9 00
CMPIM  0
859 035B   D0 07
BNE    7
861 035D   20 9103
JSR    913
864 0360   C9 84
CMPIM  132
866 0362   F0 0C
BEQ    12
868 0364   E8
INX
869 0365   8A
TXA
870 0366   C9 14
CMPIM  20
872 0368   D0 E4
BNE    228
874 036A   20 B103
JSR    945
877 036D   4C 4C03
JMP    844
880 0370   A9 80
LDAIM  128
882 0372   8D 5003
STA    848
```

More

ates CB2 pulsed strobe that is normally high, then pulsed low to print. In addition, I used the high-order byte of timer 2 at E849 (59465) in a fast-timer loop. The port A data-direction (PADD) register at E843 (59459) sets port A for output (FF).

Print Screen uses both the X and Y index registers as counters. Index register X is used to count from 0 to 19 (20 counts) for a half line, and index register Y is used to count the four pages of memory from 8000 to 83FF (actually, 1024 counts). Since the Y register is a single byte, it will only count 0 to 255 (256 bytes, one page), and then roll back to 00. For walking through the screen memory, absolute indexed addressing is used, incrementing the Y register by one on each pass. The high address byte is incremented by 1 on each rollover of the Y register (from FF to 00).

Interfacing my PET
to the Quik Printer
required some
modifications.

Lines 826 and 828 set up port A for output. Line 831 initializes the Y index register to 0. Lines 833 to 838 set CB2 high. Line 841 jumps to the subroutine at line 945, which clears the printer buffer, outputs a carriage return and line feed, and sets up a one-half-second delay. Line 844 starts a new half-line by zeroing index register X. Line 846 loads the accumulator with a new character, absolute indexed on index register Y. It is the high address in this instruction (80) that is incremented on index register Y roll-over.

Line 849 calls a load output port subroutine at line 892. This subroutine converts PET screen codes to ASCII codes, adding decimal 64 to the letters for the conversion. Line 852 calls the print character subroutine, which supplies the timing and pulses the CB2 strobe line low. Lines 855 to 857 increment Y looking for Y register roll-over. With no roll-over (it only happens four times) the relative branch is to line 868. Lines 868 to 872 look for the end of half line (when index register X equals 20 decimal).

Out of 20 tries, 19 times the relative branch is back 28 locations to line

```
885 0375   8D 8303
STA    899
888 0378   8D 9003
STA    912
891 037B   60
RTS
892 037C   C9 20
CMPIM  32
894 037E   10 07
BPL    7
896 0380   EA
NOP
897 0381   B9 0080
LDAY   32768
900 0384   18
CLC
901 0385   69 40
ADCIM  64
903 0387   8D 4FE8
STA    59471
906 038A   60
RTS
907 038B   00
BRK
912 0390   00#
913 0391   AD 5003
LDA    848
916 0394   18
CLC
917 0395   69 01
ADCIM  1
919 0397   8D 8303
STA    899
922 039A   8D 5003
STA    848
925 039D   60
RTS
926 039E   EA
NOP
927 039F   EA
NOP
928 03A0   AD 49E8
LDA    59465
931 03A3   E9 E0
SBCIM  224
933 03A5   8D 9003
STA    912
936 03A8   AD 49E8
LDA    59465
939 03AB   ED 9003
SBC    912
942 03AE   30 F8
BMI    248
944 03B0   60
RTS
945 03B1   A9 0D
LDAIM  13
```

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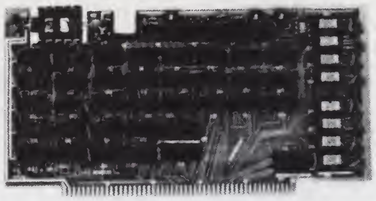

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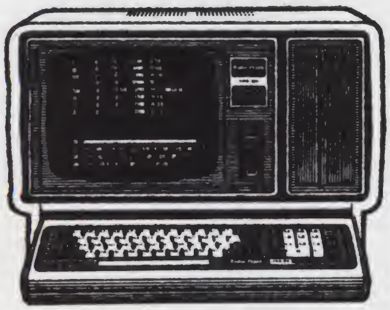

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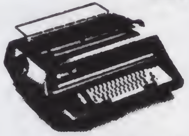

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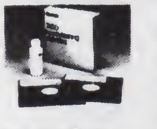

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Listing 1 continued.

```
947 03B3   8D 4FE8
STA    59471
950 03B6   20 D003
JSR    976
953 03B9   AD 0202
LDA    514
956 03BC   69 20
ADCIM  32
958 03BE   8D 9003
STA    912
961 03C1   AD 0202
LDA    514
964 03C4   ED 9003
SBC    912
967 03C7   30 F8
BMI    248
969 03C9   60
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970 03CA   A0 03
LDYIM  3
972 03CC   20 A003
JSR    928
975 03CF   60
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976 03D0   AD 4CE8
LDA    59468
979 03D3   29 AF
ANDIM  175
981 03D5   8D 4CE8
STA    59468
984 03D8   20 A003
JSR    928
987 03DB   09 E0
ORAIM  224
989 03DD   8D 4CE8
STA    59468
992 03E0   20 A003
JSR    928
995 03E3   60
RTS
```

846, loading the accumulator with the next character. On the 20th try, the program steps to line 874, which is a carriage return, line feed, one-half second delay. The program steps to line 877 and makes an unconditional jump to line 844, the start new half-line entry point. We return to the four roll-over conditions.

At line 861, only accessed at roll-over of index register Y, the program jumps to a subroutine at line 913, the increment page subroutine. This subroutine adds 1 to the high address byte at addresses 0350 (848) and 0383 (899), and leaves a copy of the high address byte in the accumulator. At line 864 the high address byte is compared to 84 hexadecimal. The first three times (81, 82 and 83), the program drops to line 868, again looking for the end of a half-line. On the fourth roll-over, the equality comes true in line 866, and the program branches forward 12 locations to line 880, and it's cleanup time before the exit.

Line 880 loads hexadecimal 80 in the accumulator. This value is then stored in 0350 (848) and 0383 (899) to reset the pointer to the start-of-screen. This value is also stored at 0390 (912), which is a temporary store location used to store samples of the two timers.

As a consequence of executing the cleanup routine (lines 880 to 888) before the return, the Print Screen program is identical before and after each execution of a SYS (826). This aids in the verification process when storing the program on tape. Lastly, line 906 is a return-from-subroutine RTS instruction, for branching control back to the calling program. It is this RTS instruction that lets you embed the SYS (826) statement in BASIC programs without losing continuity in the calling BASIC program (see Listing 2).

The Simple Connections

To communicate with the Quik Printer II, ten wires must be connected from the parallel port on the PET to the expansion interface port on the Quik Printer II. The ten wires carry the digital ground, CB2 (strobe line) and eight parallel data line (PA0 to PA7) signals (see Fig. 1).

Looking at the rear of the Quik Printer II, the left-most vertical port is the expansion interface port. The top-left contact is the no. 1 contact, and the top-right contact is the no. 2 contact. The contacts in the left column are consecutively odd as you go down the column; nos. 3 through 17 odd are the parallel data lines, with pin 3 being the PA0 line (the least significant digit), and pin 17 being PA7 (the most significant digit). Correspondingly on the PET, pin C is the LSD and PIN L is the MSD.

On the PET, the bottom contacts are used. The PET connector is a 12-position, 24-contact connector with 0.156-inch centers between contacts. The connector vendors are mentioned in the PET manuals. The Quik Printer II connector is a 17-position, 34-contact connector with a 0.1-inch spacing between contact centers. I used a manual wire-wrap tool to make these connections.

If you don't want to enter the program in machine language using the TIM monitor, I will send you a tape of it for $5. To produce the tape I used a monitor program (see "PET Mini Monitor" by William H. Perdue, Oct. 1980, *Microcomputing*, p. 88) located at 133A (4922) to copy the machine-language program to tape.■

```
.:  0338 20 20 A9 FF
 8D 43 E8 A0
.:  0340 00 AD 4C E8
 09 E0 8D 4C
.:  0348 E8 20 B1 03
 A2 00 B9 00
.:  0350 80 20 7C 03
 20 D0 03 C8
.:  0358 98 C9 00 D0
 07 20 91 03
.:  0360 C9 84 F0 0C
 E8 8A C9 14
.:  0368 D0 E4 20 B1
 03 4C 4C 03
.:  0370 A9 80 8D 50
 03 8D 83 03
.:  0378 8D 90 03 60
 C9 20 10 07
.:  0380 EA B9 00 80
 18 69 40 8D
.:  0388 4F E8 60 00
 80 18 69 40
.:  0390 80 AD 50 03
 18 69 01 8D
.:  0398 83 03 8D 50
 03 60 EA EA
.:  03A0 AD 49 E8 E9
 E0 8D 90 03
.:  03A8 AD 49 E8 ED
 90 03 30 F8
.:  03B0 60 A9 0D 8D
 4F E8 20 D0
.:  03B8 03 AD 02 02
 69 20 8D 90
.:  03C0 03 AD 02 02
 ED 90 03 30
.:  03C8 F8 60 A0 03
 20 A0 03 60
.:  03D0 AD 4C E8 29
 AF 8D 4C E8
.:  03D8 20 A0 03 09
 E0 8D 4C E8
.:  03E0 20 A0 03 60
 7E A0 F3 84
```

Listing 2. Hex dump of the Print Screen program.

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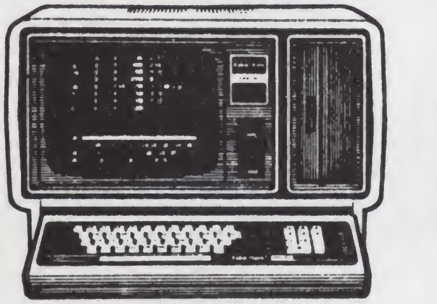

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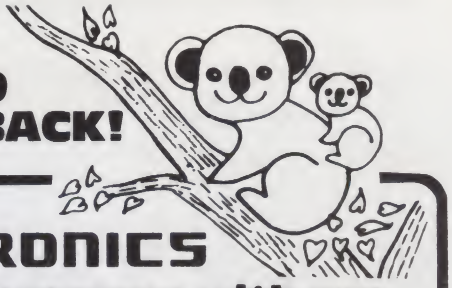

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This Apple word processor, with its "window concept," shows how your page will be printed.

What You See Is What You Get

By David C. Goodfellow

I bought my Apple II in August of 1978, mainly for word processing. Unfortunately, at that time Apple II word processing was just a dream.

But if ever a dream has come true, word processing is it. Today you can pick from many systems for the Apple, and seldom go far wrong. They all try to make a typewriter of the Apple, and they all claim to be the best on the market—and the beauty of it is that most of them seem to have one or two features that back up that claim.

This a happy problem for the buyer; happy because he now has a choice, and a problem because there are so many good word processors to pick from. The difficulty is not in finding a system that works, so much as finding one that fits your work habits and the kinds of typing jobs you wish to do.

It's important to pick the right program for two reasons. First, few of us can afford to buy one word processing program after another at $50 to $250 a clatter. Second, becoming proficient in the use of any word processor, no matter how basic, requires much time. If you can pick software that's right for you, and stick with it for all your word processing needs, you're far better off than if you have several systems and are master of none.

Magic Window, by Artsci (10432 Burbank Blvd., North Hollywood, CA 91601, 213-985-2922), is a good, serviceable system with several features that make it exceptional. One of these is that it makes your Apple act more like a typewriter than do most other word processing systems. Designed with a "what you see is what you get" concept, Magic Window puts a simulated sheet of paper on the screen. When you type, the words appear on the screen in the location they will occupy on the paper. With one or two minor exceptions, formatting commands are done elsewhere, so they do not clutter up the screen.

Another feature that I especially like is the fact that you can save your files in either of two ways—formatted (binary) or unformatted (text). You can save the same file both ways, as long as you use a different file name.

Binary files are great. They take less disk space than text files, and are saved and loaded faster. In most cases I would prefer to save my text in a binary file.

But text files do have their uses. One of these is data communication. If you want to squirt a letter or a program to a friend with another computer (whatever its brand name), you can send a text file over the telephone. That's one of the few ways different brands of computers can talk to each other.

Also, a word processor which can use text files can be used to debug—or create—other software. Write a program with Magic Window, and save it as a text file. Execute that file and your program's ready to run. If it needs debugging, suck it back into Magic Window and use its editing tools.

Details

The program is fully menu-driven. Menu selections take you in for specific functions, and menu selections bring you out. The master menu, called Subsystem Menu, gives you six choices—Editor Subsystem, Format Subsystem, Filer Subsystem, Printer Subsystem, Configuration Subsystem and Exit to Basic.

● Editor Subsystem. Selecting the editor from the subsystem menu gives you a simulated page on the screen, on which to type. Here you type whatever text you wish, backspacing to correct typographical errors that you may spot as you go along. The program gives you a window to the page, so you can pretty much see what the page will look like. Since the Apple II screen is only 40 characters wide, this window does not show the whole page—but what you do see is a good representation. You back out of the editor function through a control sequence SHIFT-CTRL-P—the three keys held down at once. This returns you to the subsystem menu.

Editing functions include—

Cursor motion group (left, right, up, down, up half-window, down half-window, top of file, end of file, set tab stop, clear tab stop, clear all tab stops, tab left, tab right, assign search string, search for assigned string and cursor to page sequence)—This last item allows you to find the top of any selected page in your document.

Character editing group (delete, insert, copy and control characters)—The control characters command allows you to enter a control character in text to implement a special printer function you may have.

Line editing group (deleted line stack, delete, recover, moving lines, insert, clear, split, glue, justification)—Justification includes center line, left justify line, right justify line, expand line (left/right justify) and pack line. Justification is done on-screen, a line at a time, and with use of the REPT key is quite fast. Split-and-glue is the program's equivalent of the cut-and-paste operation many typists go through to avoid retyping the doc-

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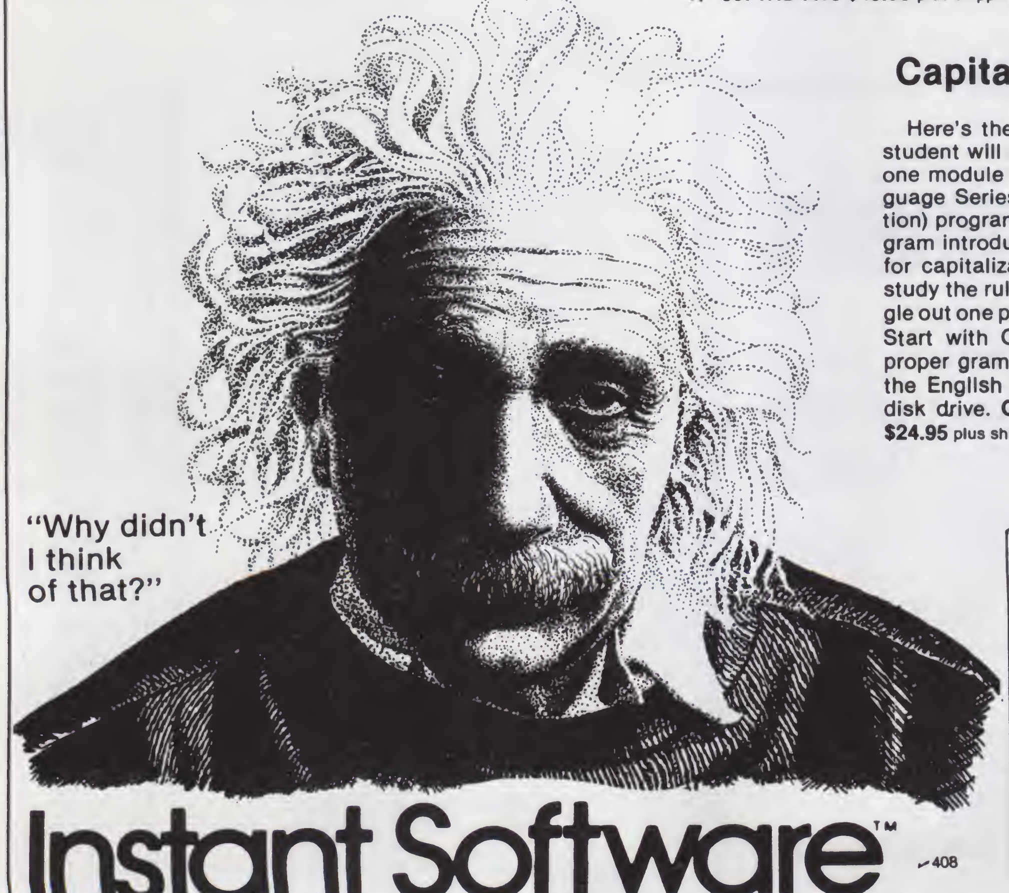
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ument. The line is split at the chosen point, and new text is added at the split.

Other functions (assign title line, and exchange key sets)—Assign title line allows you to put a title and page number in what is normally the white space of the top or bottom margin. Exchange key sets makes available the backslash, left-and-right brackets and left-and-right curly brackets on the display—characters not normally available on the Apple keyboard.

- Format Subsystem. Format allows you to specify page length, left margin, text width and whether or not you wish double-spacing.
- Filer Subsystem. Filer choices are change disk options, files directory, save formatted file, load formatted file, unformatted load/save, delete file and clear file in memory. Each function is supported by its own directions, appearing on the screen when that function is selected.

Points of interest in the Filer Subsystem are change disk options and unformatted load/save. Disk options that may be changed are disk slot and drive number, and the volume number of the disk to be used. Unformatted load/save gives you the choice of change range option, save file, load file and insert file at cursor. These are powerful features, which you can use to piece together a document from paragraphs in a text file. Suppose you have document A in memory, and you wish to add paragraphs from document B, which is in a text file. With "change range option" you select the desired part of document B, and with "insert file at cursor" you place it where you want it in document A.

- Printer Subsystem. Printer allows you to change print options, print hard copy or print soft copy. Printer options include yes/no answers to "print lowercase" (yes means caps and lower), "print all pages," "stop at page end" (sheet feed) and "mark perforation." Also, you may decide what page number to start at. The option to mark perforation is a valuable feature for special-paper printers such as those which print on heat-sensitive paper. The paper for these comes in rolls, with no means to show page end. This option puts a series of dashes across the paper to indicate where to cut it for page division.

"Print softcopy" saves the file to disk as a text file. You can do the same thing with an unformatted save from the filer subsystem—except that "print softcopy" gives you a text file that must be printed from another program (sample listing supplied).

There is a reason for this. With the simple print program and a text file saved with soft copy, an untrained operator can handle the printout while you go on to bigger and better things. And, that printout can be interrupted for personalized inputs from the keyboard or a data file.

- Configuration Subsystem. This function allows you to change the configuration options, update configuration boot file, boot the configuration file or load the RAM printer driver. These are all well-explained in the manual, and pertain to matching your printer with the program.

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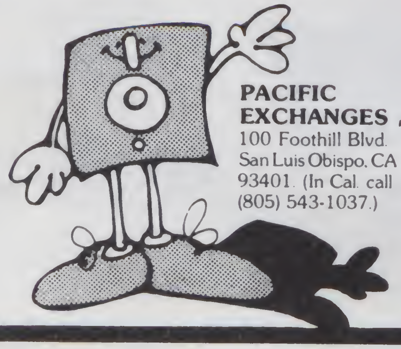

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progressive computing

with it I can get a better idea of how the page will look when printed. This concept will be especially useful when the program is made to support an 80-column board—in about December, according to Bill Smith of Artsci.

I also like the choice of binary or text files, as discussed earlier.

The ability to assign a title line within the top or bottom margin (outside the space regularly available for text) is a real convenience.

As a special order option, Artsci supports the special features of a number of printers—Diablo and Epson among them. The Diablo package includes incremental spacing, which I consider to be important. It makes the program that much more capable of competing with the expensive systems used by many large companies.

A deleted line is not necessarily lost forever. Instead, it is placed on a stack of such lines, and may be replaced in its original position or moved to another location. As many as 16 lines may be moved at one time in this fashion.

The manual is excellent, with one exception (discussed below). All the necessary information is there, at a level even I can understand. Also included is a color crib sheet to be posted nearby for reference. This sheet is a drawing of the Apple keyboard, with each key's control function defined. The drawing is also reproduced in the manual itself, in black and white.

Weak Points

The pack line function deletes all extra spaces between words. This is a good function for making room to insert a forgotten character and so on, but it is not selective. Typing rules call for two spaces after a period ending a sentence. Pack line deletes the second space, and it is often quite difficult to replace it. The problem is compounded when a line is expanded after packing, for the result is often one space after the period and two spaces somewhere else.

Although the program has a good search string function, it could do with a find-and-replace, in which a selected phrase or word is automatically replaced by another. I imagine this would be difficult to do with a program such as this which specifies line length before typing is started.

The structure of the program does not allow changing the line length of an existing document, unless you go through the hassle of split-and-glue before printing with the new line lengths. My particular application sometimes demands this, to print out the same document with a different type size and format. But my application is probably not typical.

Although the manual is excellent, I think one more section is in order for a program of this complexity. That is an exercises chapter which takes you through the system—inputting text, exercising all the editing functions, saving to disk in all the ways possible and outputting to the printer. The manual as it stands is a reference book—it needs to lead the user through some hands-on experience.

The manual also should tell the reader what options are available for the system—such as printer routines for specific printers. These routines are available, and they make the system that much more valuable. The

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CORRECTIONS

The correct title of the article by Michael Brandt and Michael Brodner in the October 1981 issue of *Kilobaud Microcomputing* (p. 80) is "Distributed Intelligence Networks in the Office Environment."

The program listing of "An Incredible High-Speed Journey to the Stars" as published in the September 1981 *Kilobaud Microcomputing* (p. 172) is incomplete. The following lines should be added to the end of the program:

```
1710 REM ROUTINE TO READ DATE.
1720 INPUT "Type date here: ",M8,D8,Y8
1730 IF M8>12 THEN 1770
1740 IF D8>31 THEN 1770
1750 IF Y8<1800 THEN 1770
1760 RETURN
1770 PRINT "Invalid format. Date must be of the
form 8,21,1940"
1780 GOTO 1720
1790 DATA "SiriusCanopusAlpha CentauriVega-
RigelProcyonBetelgeuseAltair"
1800 DATA "SpicaAntares"
1810 DATA 2.7,90,1.3,8.0,250,3.5,200,5.1,70,120
1820 DATA 1,6,7,13,14,27,28,31,32,36,37,43,44,
53,54,59,60,64,65,71
```

way it's handled now, follow-up letters are sent to those buyers who send in the registration cards included with the package.

Conclusion

The more features available on a word processing program, the more complex is its operation. Magic Window is no exception. Making full use of the program's capabilities requires practice. Although you'll be able to do simple jobs with Magic Window almost immediately, it will take some time to become an expert with all its capabilities.

The system requires an Apple II or Apple II Plus with at least 32K RAM and a disk drive. It is more effective with 48K RAM and a second drive, and it will support a lowercase adapter (such as Paymar's) and the Apple Language System, which gives it 10K more text storage.

Magic Window represents an easy transition from typewriter to computer. The program was designed with the typist in mind, and a newcomer to word processing is not likely to be intimidated by it. At $100 retail, it's a good buy.■

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Don't put off those interface projects any longer. Construct a parallel port board for the C1P and open up a whole new world of applications.

Arm the OSI With Parallel Ports

By Roy Griffin

In the months before I bought my Ohio Scientific Challenger 1P, I had collected several hardware projects that I planned to build and use with it. All these projects had one thing in common: they all interfaced through one or more parallel I/O ports, which the single-board C1P doesn't have.

I could have bought OSI's parallel port board, but I would also have had to buy their expansion (610) board. Since I had already spent all I could afford, I decided to design my own board. For the C1P or Superboard II, it can turn your computer into an important tool for control applications in the real world.

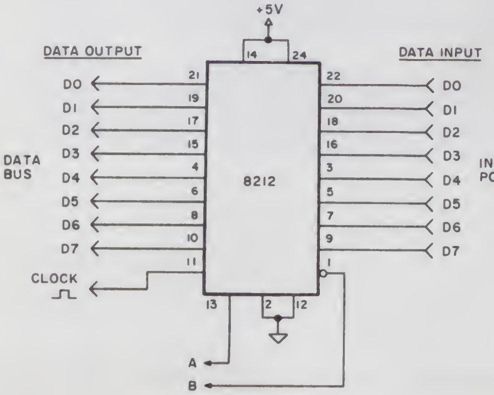
If you don't have a C1P or Superboard II, read on; with an understanding of the concepts involved and with some modifications, this board could be used with virtually any eight-bit microcomputer.

The Intel 8212

The heart of the parallel port board is the Intel 8212 I/O port IC. I chose this chip for several reasons: it is inexpensive and easy to get (you can mail order it from almost any electronics or computer parts supplier for about $3.50), and it's versatile. The chip can be configured as an input port or as an output port, and it has tri-state capabilities.

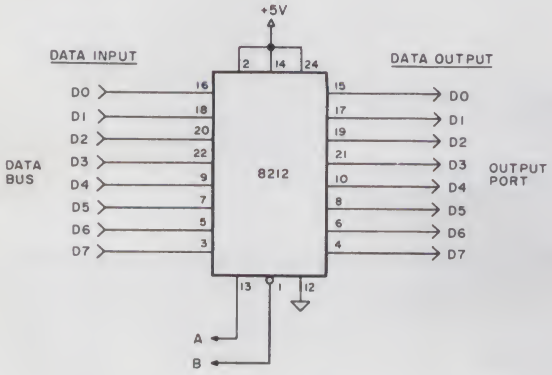
Fig. 1 shows the 8212 configured as an input port. With either pin 1 high (+5 V) or pin 13 low (0 V), the output of the 8212, which is connected to the data bus, is in the tri-state or high-impedance mode. This is equivalent, as far as the data bus is concerned, to having the 8212 and the data bus completely disconnected from each other.

When pin 1 is pulled low (grounded) and pin 13 is pulled high (+5 V) at the same time, the output of the 8212 becomes active: a positive-going clock pulse at pin 11 transfers data from the input port lines to the data bus. When the clock pulse goes low the 8212 latches, completing the data transfer. After the transfer has taken place, returning pin 1 high or pin 13 low causes the 8212 to again enter the high-impedance state.



A	B	CLK	DATA OUT EQUALS
0	0	X	TRI-STATE
0	1	X	TRI-STATE
1	0	0	LATCHED
1	0	1	DATA IN
1	1	X	TRI-STATE

Fig. 1. The 8212 IC as an input port.



A	B	DATA OUT EQUALS
0	0	LATCHED
0	1	LATCHED
1	0	DATA IN
1	1	LATCHED

Fig. 2. 8212 output port.

Address correspondence to Roy Griffin, 2906 B East Glen, El Paso, TX 79936.

Fig. 2 shows the 8212 configured as a latching output port. To transfer the contents of the data bus to the output port, you pull pin 1 low and pin 13 high. Returning either pin 1 to (+5 V) or pin 13 to ground will cause the output of the 8212 to latch.

Designing around the Challenger

The Challenger 1P and Superboard II are based on the 6502 processor. This fact is notable in that the 6502 processor does not have separate control signal outputs for I/O operations and for read/write (memory) operations. This means that the CPU does not know the difference between an I/O port and a memory location. You cannot therefore assign both an I/O port and memory to the same address. Some other processors, such as the 8080 or Z-80, have provisions for just such an overlap of memory and I/O ports.

Since the 6502 processor does not distinguish between memory and I/O ports, you must be careful to choose as a location for the I/O ports an address that will not conflict with any memory in the C1P or with any memory you might want to add later on.

By consulting a memory map in the user's manual, I decided on decimal locations 63232 through 63235. In analyzing the Superboard II schematics, I noticed that the designers of the C1P skimped a bit on their address decoding: they assigned more than one address to some of their memory and serial port locations. While this is not good design practice from the standpoint of expandability and efficient use of memory space, it does save on parts count and makes things less expensive. I opted for the same approach and only decoded ten address lines in my design.

Fig. 3 shows the address decoding circuitry for the parallel port board, along with the bidirectional bus transceivers (8T28s), an input port and an output port, and some control circuitry to make things happen at the right times.

The output lines of the 74LS155 decoder control which I/O port is to be accessed by pulling pin 1 of the appropriate port low. The buffered read/write line is connected to pin 13 of each of the input ports to enable the input ports only on a memory read cycle. The inverted read/write line connects to pin 13 of each output port to assure that the output ports are enabled only on a memory write.

The 8T28 ICs of Fig. 3 are not really necessary for the C1P because there are bus transceiver sockets on the board already. However, I have included these ICs on the parallel port board so it can be used with other computers without loading down the data lines. Included in Fig. 3 is some logic circuitry to change the data direction of the 8T28 bus transceivers at the appropriate time.

Fig. 4 shows the remaining two input and output ports. They occupy locations 63234 and 63235 (decimal). The two 74LS365 ICs form an input status port and an output status port.

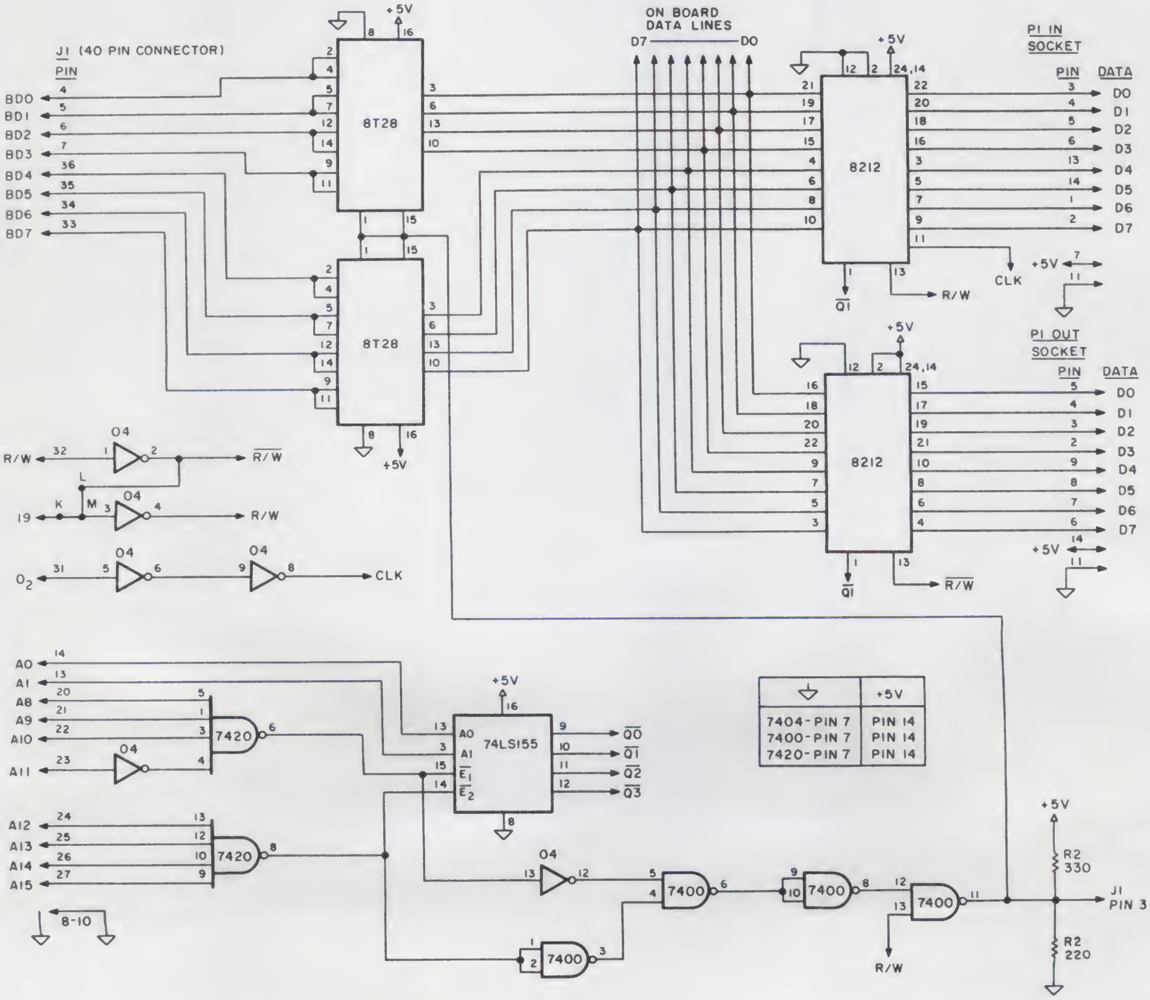


Fig. 3. Port 1 and decoding logic schematic.

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They can be used to provide necessary handshaking signals such as data ready and data received acknowledge, which ensure that the data transfer between the port and peripheral is done successfully. I think it will become clear how these lines are used when you hook up your first peripheral to the port board. Note that these handshaking signals are provided to or obtained from the peripheral through software.

The 74LS365 ICs are unidirectional buffers. These buffers have two enable pins and tri-state outputs. They work like the 8212 output ports except that in the 74LS365s, the outputs do not latch. They remain in a tri-state condition unless a data transfer is taking place. The status ports occupy location 63232 and are generally accessed before a data transfer to see if both computer and peripheral are ready to make a data transfer, and after a data transfer to see if the transfer was successful.

Construction

The component side of the parallel port board is shown in Fig. 5, and the bottom side in Fig. 6. Fig. 7 shows the component placement on the component side of the board. Before you start madly soldering components to the board, be sure to use the board as a template and mark the mounting hole locations on the top of the C1P case. This will make mounting the

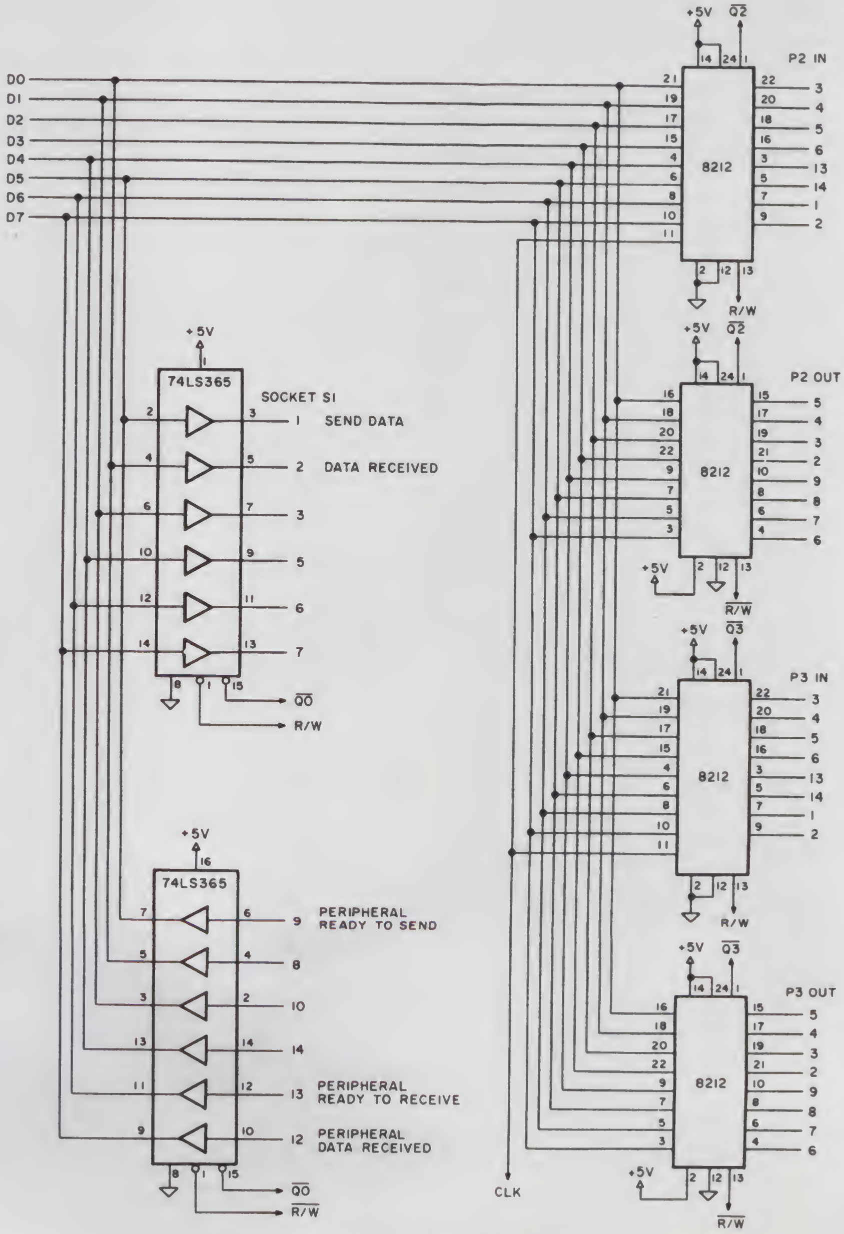

Fig. 4. Ports 2, 3 and status port schematic.

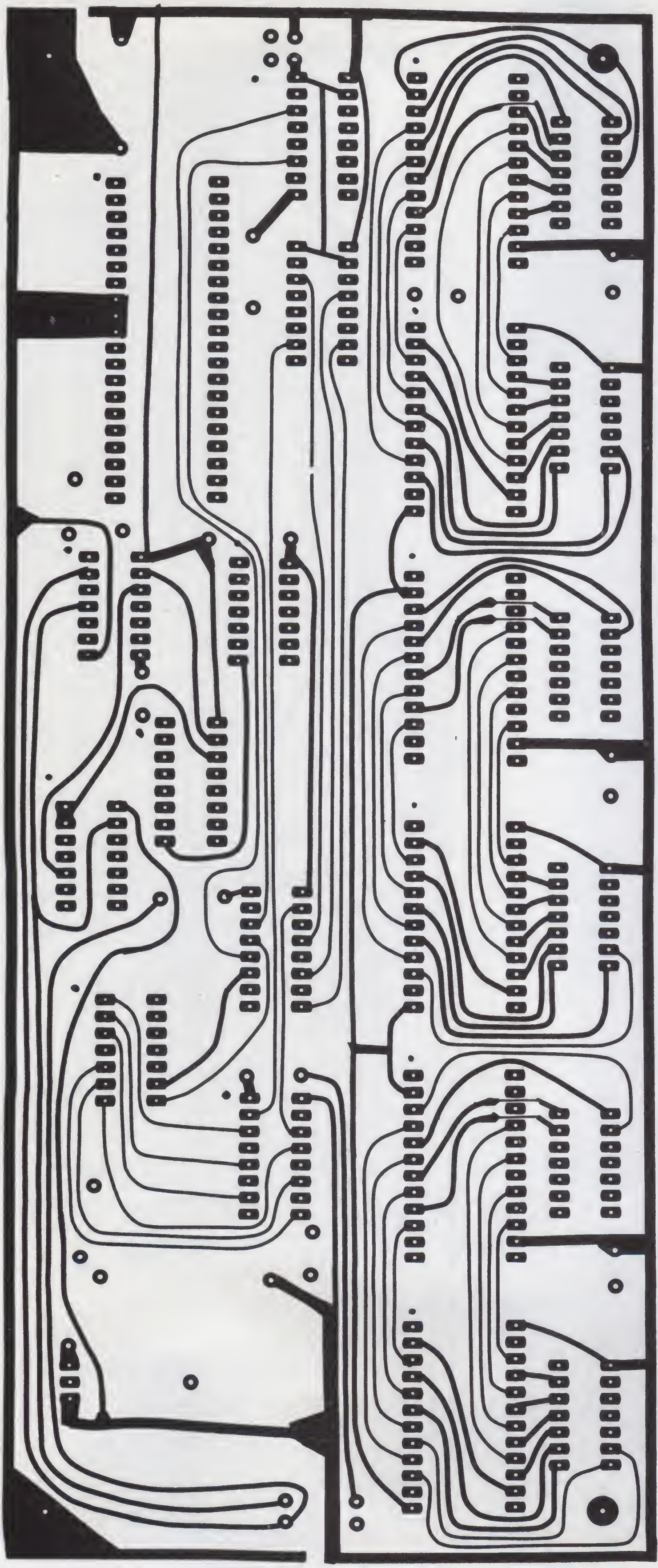

Fig. 5. Component side of parallel port board.

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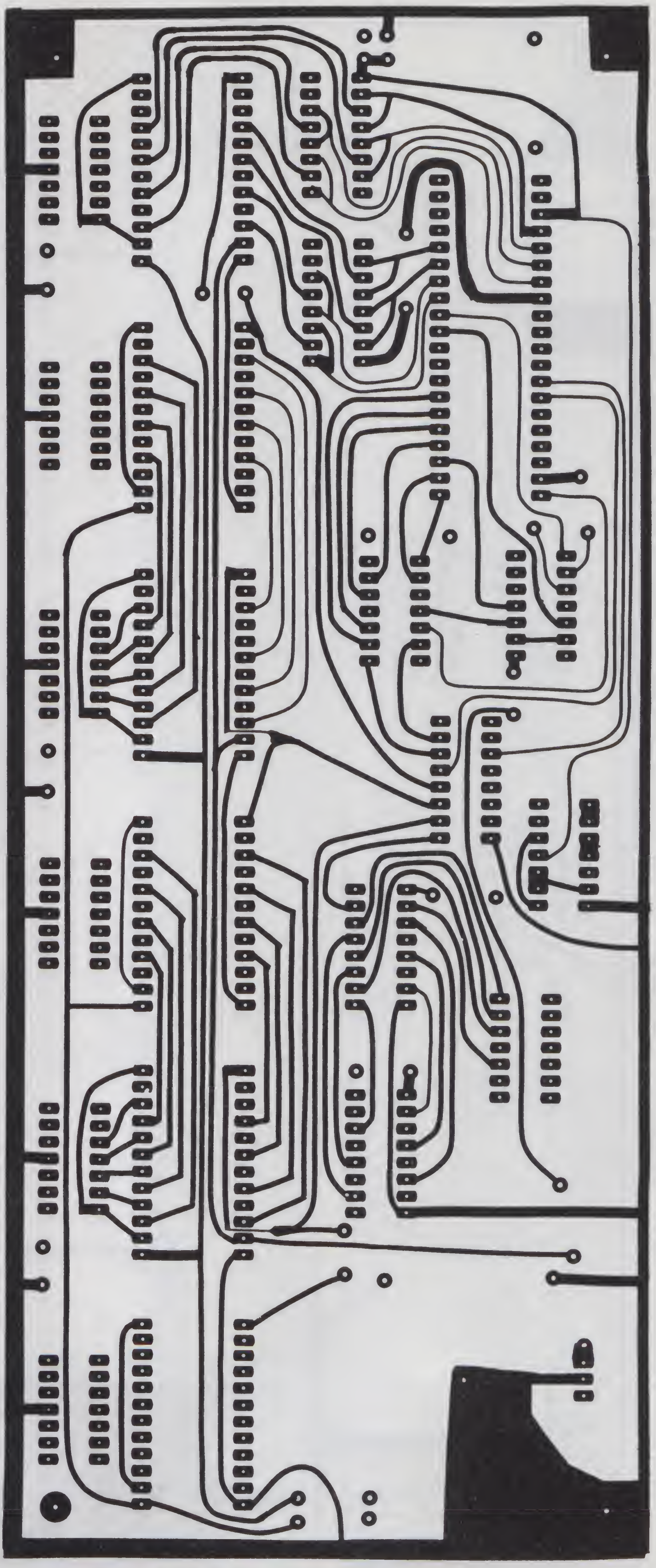

Fig. 6. Bottom side of parallel port board.

board much easier.

All the holes on the board may be drilled with a 60 drill bit (available at any hobby shop) with the exception of the mounting holes. All holes used for mounting purposes—i.e., the four board mount holes and the regulator (7805) mount hole—will require a 3/16-inch drill bit.

If your PC board does not incorporate plated through holes, you must solder every component on both sides of the board. Also, if you don't fully populate the board, you will need to provide feed-throughs in the unpopulated holes or the board will not work. Where IC sockets are needed, use wire-wrap sockets, and solder them in with the sockets standing off from the board at least .2 inches. This .2 inch clearance gives you enough room to get a soldering iron underneath the socket to solder the leads on the top side of the board. It is also better to install the necessary sockets before mounting any other components on the board. Once the socket has been mounted, you can clip off the excess lead length.

Note that there is a small dot near each IC location to indicate the pin 1 alignment for that IC. A dot is also shown in Fig. 7 to indicate which pin is pin 1. Note also that all ICs face in

Qty.	Items
1	Printed circuit board
6	8212—24-pin IC
2	8T28—16-pin IC
2	74LS365 or 367—16-pin IC
1	74LS155—16-pin IC
1	7404—14-pin IC
1	7420—14-pin IC
1	7400—14-pin IC
1	330Ω 1/4 W resistor
1	220Ω 1/4 W resistor
1	7805 regulator
1	Regulator heat sink
1	330 uF/10 V capacitor
1	40-pin DIP socket
6	14-pin DIP socket
1	16-pin DIP socket
3	.01 uF/50 V disc. cap.
1	40-pin DIP cable
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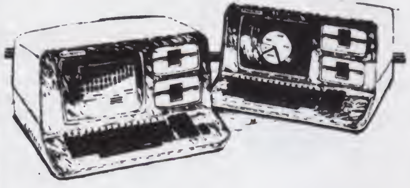

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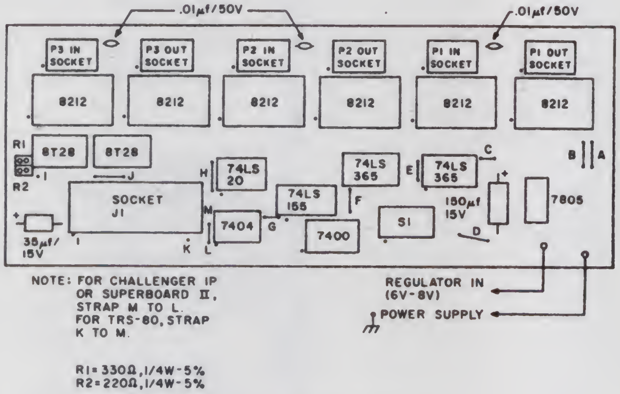
the same direction with respect to pin 1 on Fig. 7. You will notice on Fig. 7 some jumpers labeled A through M. These jumpers should be made of insulated wire to prevent shorting out traces on the board.

Once all the components have been mounted on the board, some dc power source of between 6 and 8 V must be connected between the input of the 5 V regulator (7508) and ground. I used the rectified output of the power supply provided in my C1P. This is all right as long as the power supply has the ability to provide the extra current needed to run the parallel port board. If the power supply is inadequate you will most likely either blow a fuse or have trouble getting your computer to operate properly. A heat sink on the 7805 regulator is necessary to keep the 7805 from overheating.

After the board has been assembled, drill 3/16-inch holes in the top of the C1P case, open it up and mount the board with the I/O port sockets facing toward the back of the computer. You will need to remove the six screws that hold the keyboard in place. The port board will mount between the computer board and the top of the case. It will probably be easier to test the port board with the C1P in this disassembled condition. Watch what you touch, though. There are some dangerous voltages near the on/off switch.

After mounting the board on the inside of the C1P case on 1/4-inch spacers, plug in a 40-pin DIP jumper cable (you'll need about 12 inches) between the C1P expansion socket (J1) and the 40-pin socket on the I/O port board. Make sure that the pin 1 cable mark-



NOTE: FOR CHALLENGER 1P
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STRAP M TO L.
FOR TRS-80, STRAP
K TO M.

R1 = 330Ω, 1/4W-5%
R2 = 220Ω, 1/4W-5%

Fig. 7. Component placement.

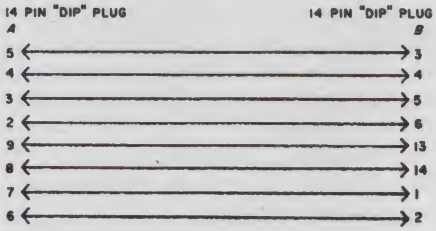

Fig. 8. Test cable wiring diagram.

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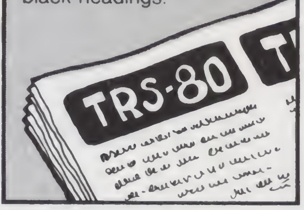

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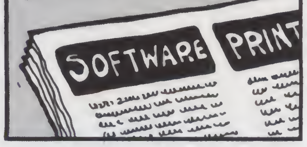

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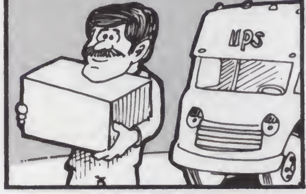

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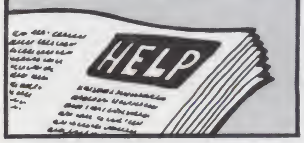

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ers correspond to pin 1 on each of the two sockets; otherwise, you may damage your C1P.

There is one other thing I think I should mention. My Challenger came without the 8T28s plugged into the U6 and U7 sockets on the computer board. You will need these ICs or the parallel port board won't work.

Testing

Fig. 8 shows a wiring diagram of a cable that can be used to verify that the port board is functioning properly. Once the cable has been made, label it as per the figure (*this is important*). Then connect the A side of the cable to the P1 out socket, noting the pin 1 alignment. Connect the B side of the cable to the P1 in socket, also noting the pin 1 alignment.

Type in the test program and run it. The program will output to output port 1, which will in turn input to input port 1 for verification. If the test fails, the program will print which bits are not working. Ports 2 and 3 can be checked by moving the cable between the appropriate port sockets (i.e., P2 in–P2 out, P3 in–P3 out) and running the program.

Using the Board

To transfer data to an output port, simply use the basic POKE command just as you would if you were transferring data to a memory location. For instance, the command "POKE 63233,200" would transfer the binary equivalent of the decimal number 200 to output port 1, "POKE 63234,100" would transfer the binary equivalent of the decimal number 100 to output port 2, and so on.

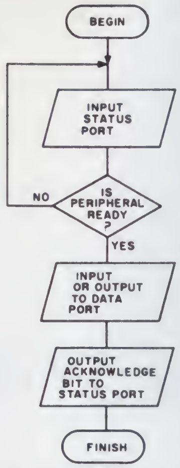
BEGIN
INPUT STATUS PORT
NO
IS PERIPHERAL READY ?
YES
INPUT OR OUTPUT TO DATA PORT
OUTPUT ACKNOWLEDGE BIT TO STATUS PORT
FINISH

Fig. 9. I/O transfer flowchart.

Similarly, to transfer data from an input port to the data bus, use the PEEK command just as you would use the PEEK command to get data from a memory location.

To implement a working I/O transfer situation, you may want to (or need to) use the input and output status ports to provide handshaking signals between the computer and the peripheral. The status port pins of Fig. 4 have been assigned control functions, although these assignments are arbitrary and could be changed at will.

Fig. 9 shows a flowchart of a typical input and output data transfer. The parallel ports you now have available to your microcomputer can open up a whole new world of applications. With its 24 input lines, 24 output lines and 12 status lines, your computer can begin to control and monitor the outside world. ■

```
100 PRINT "WHICH PORT DO YOU WANT TO TEST—1, 2, 3"
110 INPUT X: IF X≠1 AND X≠2 AND X≠3 THEN 100
120 Y=63232+X
130 X=0
140 GOSUB 400
150 Z=1
160 GOSUB 400
170 Z=2
180 GOSUB 400
190 Z=4
200 GOSUB 400
210 Z=8
220 GOSUB 400
230 Z=16
240 GOSUB 400
250 Z=32
260 GOSUB 400
270 Z=64
280 GOSUB 400
290 PRINT: PRINT: PRINT: PRINT "TEST COMPLETE"
300 GO TO 100
400 POKE Y, Z
410 A=PEEK (Y)
420 IF A≠Z THEN GOSUB 500
430 RETURN
500 PRINT "PORT" X "FAILS"
510 PRINT "INPUT= "Z "OUTPUT= "A
520 RETURN
```

Test program.

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For those big boppers who tape music (or other material) from records, this Micropolis program offers several methods of balancing the timing of the tape.

Keep in Tune with the Times

By Joel Shapiro

Like many music buffs, I like to transfer my prized records to tape before they show signs of wear.

The main problem isn't transferring the music, but doing so with a minimum amount of dead time on either end of the tape. The manual calculations required are usually more than I care to do, forcing me to accept a less professional recording than I want.

This program, written in Micropolis BASIC (version 4.0), is designed to make tape recording easier. It requires only a single-drive system, and, although I have a 48K memory, program capacity and size can be reduced for systems with less. You also need an 80-column printer.

Some of the program's features are as follows:

It uses a disk file for record data. All record data for both singles and albums is entered into a disk file, so you can get different mixes.

All record and tape times are entered in minutes and seconds. All time conversions are done within the program. Operator prompting and console messages are also in the same format.

It has adjustable timing within the program. The number of selections that can be entered can exceed the time available on the tape. Selections can then be deleted from the selection array and will not be considered in the time calculations. This in no way affects the data on disk, as that remains unchanged.

It can space between selections. You can add up to ten seconds of space between each selection, which is considered in the calculations.

It has three different methods of balancing. This should suit both the type of music being recorded and your personal preferences.

It prints a list of selections in balanced format. The printed listing shows how each selection should be placed on the tape for balance within the criteria selected by the user. This will also double as a catalog sheet for use in a library function.

It sorts output. Whenever possible, the output report will show selections in album order for ease in recording.

Although written in Micropolis BASIC, many of the statements have similar functions provided by other BASICs, so conversion to yours should present few problems.

The Program

The program is over 11K in length. This can be reduced by eliminating the REMARK (shown as ! in the listing) statements. You can further reduce the program size by decreasing the amount of text used in the prompts and error messages.

The arrays accommodate up to 60 selections; if available RAM becomes a problem, this can be reduced. Note that variable B% is set to 60 in line 110 of the program and is used for both a loop terminator and for the timing calculations. If you do decide to reduce the capacity, be sure you don't affect the calculations in lines 180 and 190.

Note the statements in lines 400 through 520. These provide the CLEAR SCREEN and VERTICAL CENTERING for my system and should be changed to accommodate yours. The USER DEFINED FUNCTION (FNA) in line 50 serves to center a line of text horizontally on the screen.

The STRING statement in the same line changes the string delimiter to ASC(255). The normal string delimiter in most BASICs is a comma, and if that is the case with yours, you'll have to be careful not to use a comma in any of the text entered into the program while in operation.

Micropolis BASIC uses fixed-length strings, and these must be defined in arrays. Note in line 100 that all string arrays dimensioned show two numbers within the parentheses. The first number is the number of elements in the array. The second is the maximum length of the string allowed in the array.

The subroutine in lines 200 through 220 requests a file name, searches for the file on both drives and opens it if found. If it can't be located, you will be asked if you wish to create one. Once the file is created, operation continues normally.

The subroutine in line 240 prints a line of periods matching the length of the text being requested, and serves to show the user how much text will be accepted in the string.

All program functions are selected from the main menu in lines 1500–1540, and all program functions will return to this menu upon completion.

Adding Data to File

This function, which begins in line

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1550, lets you add data to an existing or newly-created file. The first entry required determines whether an album or single selection is being entered. If an album is entered you'll be asked to enter a series of selections for each side. If it is a single, you'll be allowed only one selection per side.

Album titles are recorded on the disk, as are the selections. However, each is recorded in a different format so the system recognizes each of them. The coding is done in variable J$, which can be broken down into five characters. The first two characters denote the album number, the next denotes the side and the last two denote the band or selection number.

An album title will show only the album number and 000. A single will show 00, A or B for the side and 01 for the selection. An album selection will show album number, side and selection number. Note that album numbers and selection numbers are determined by the system and are not entered by the user.

This may be a good time to explain the FMT statement used in this BASIC. The statement is similar to a PRINT USING statement but can also be used in formatting data for use in the program or in the files. Referring to the FMT statement in line 1640, R% is formatted to the string "99." If R% was equal to 5, the resultant string after use of the FMT statement would be "05." This is because the FMT statement will replace each "9" in the string with a 0 unless a digit for that position is present in the variable (R%).

Since the FMT statement is used frequently throughout the program, it would be worthwhile to write a subroutine to duplicate the function if your BASIC doesn't have its equivalent.

In the input sequence the backslash will be used to terminate entry for each side of each album and also to terminate the entry sequence. There is nothing sacred in using a backslash for these operations. I use it only because it's handy.

Note that the record time is entered in minutes, (space), seconds format. This BASIC will accept either a comma or a space between numerical entries. You may use a comma to delimit each number if yours requires you to do so.

After termination of the data entry sequence, a final record will be written into the file and the file closed. The final record is used to retain the album number of the last album entered so the number won't be duplicated if you make additional entries.

Performing Calculations

With this function, the file will be accessed and read into memory; the console will show how many entries are in the file and their timing. Note that the timing shown per side is just the total time divided by two and is to be used only as a guide in planning your recording.

It is in lines 1770–1790 that the file is read, album titles are separated from selections and both types of data are stored in their proper arrays. Line 1810 requests that you add up to ten seconds of allowance between selections, and line 1820 adds that into the timing array.

Program Listing. Tape recording program in Micropolis BASIC.

```
  10 !                TAPEREC
  20 !    RECORD TO TAPE RECORDING CALCULATOR
  30 !    BY JOEL SHAPIRO - BONJOEL ENTERPRISES
  35 !    (C) 1981 BONJOEL ENTERPRISES
  40 !
  50 DEFFNA(X$)=40-INT(LEN(X$)*.5):STRINGCHAR$(255):Y$=CHAR$(255)
 100 DIMB$(20,5),D$(20,40),G$(20,40),J$(60,5),C$(60,40),R$(60,40),A$(100),M%(60),C%(60),N%(60),H%(60)
 110 B$="\":Z$="9999":B%=60:T=20
 120 GOTO1510
 170 !    CALCULATE MINUTES AND SECONDS
 180 M=M%\B%:S=MOD(M%,B%):RETURN
 190 M=M%(I)\B%:S=MOD(M%(I),B%):RETURN
 200 !    ACCESS FILE
 202 IFN$<>""GOSUB410:PRINTTAB(T)"Same File: ";RIGHT$(N$,LEN(N$)-2);:GOSUB560:IFA$="Y"N$=RIGHT$(N$,LEN(N$)-2):GOTO0206
 203 GOSUB410:PRINTTAB(T)"Enter Name of File or \ to Exit Routine"
 204 PRINT:PRINTTAB(T);:INPUTN$:IFN$=B$GOTO1510
 206 FORN=0TO1:A$=MID$(STR$(N),2,1):OPEN1A$+":"+N$ERROR210
 208 N$=A$+":"+N$:F=ATTR(1):RETURN
 210 IFERR=4ORERR=7NEXTN:IFERR=7PRINTTAB(T)"Drive 1 not up - correct and":PRINTTAB(T);:GOSUB550:GOTO0206
 211 IFERR=4GOTO214
 212 PRINT:PRINTTAB(T)"DISK ERROR - ";ERR$;" - STOPPED":PRINTTAB(T)"Correct and ";:GOSUB550:GOTO0202
 214 GOSUB410:PRINTTAB(T)"File cannot be found on Disk":PRINTTAB(T)"Do you wish to create a new file";:GOSUB560:IFA$="N"N$="":GOTO
     1510
 216 A=0:PRINT:PRINTTAB(T)"Enter DRIVE NUMBER for new file";:INPUTA:IFA<0ORA>1GOTO216
 218 N$="":PRINT:PRINTTAB(T)"Enter NAME for new file";:INPUTN$:N$="N:"+FMT(A,"9:")+N$
 220 OPEN1N$:N$=RIGHT$(N$,LEN(N$)-2):RETURN
 240 PRINT"    ";REPEAT$(CHAR$(46),X%);CHAR$(13);:PRINTREPEAT$(CHAR$(32),T);:RETURN
 299 !    WRITE RECORD TO FILE
 300 PUT1RECPUT(1);M;Y$+J$+Y$+C$+Y$+R$+Y$:RETURN
 310 !    WRITE FINAL RECORD TO FILE
 320 X$="":PUT1RECPUT(1);R%;Y$+X$+Y$+X$+Y$+X$+Y$:ATTRS(1)=F:CLOSE1:RETURN
 400 !    CLEAR SCREEN
 410 PRINTCHAR$(26)
 420 !    SPACE DOWN 11 LINES
 430 PRINTREPEAT$(CHAR$(13)+CHAR$(10),11):RETURN
 510 !    CLEAR SCREEN - NO SPACE DOWN
 520 PRINTCHAR$(26):RETURN
 550 INPUT"Press RETURN When Ready ";A$:RETURN
 560 INPUT" (Y or N)";A$:IFA$<>"Y"ANDA$<>"N"GOTO560
 570 RETURN
 600 !    CALCULATE MINUTES AND SECONDS FOR TOTAL TIME
 610 GOSUB180:PRINTTAB(T)"Total Time =";M;"Minutes,";S;"Seconds":PRINT:M%(0)=M%*.5:I=0:GOSUB190:PRINTTAB(T)"or";M;"Minutes,";S;"Se
     conds per side of Tape":PRINT:RETURN
1500 !    MAIN ENTRY POINT
1510 GOSUB410:A$="TAPE RECORDING TIMING PROGRAM":PRINTTAB(FNA(A$))A$:PRINT:PRINTTAB(T)"Functions Available":PRINT
1520 PRINTTAB(T)" 1) Add Data To File":PRINTTAB(T)" 2) Calculate Timing/Print Report":PRINTTAB(T)" 3) Write-Protect Disk File":PRI
     NTTAB(T)" 4) Delete File From Disk":PRINTTAB(T)" 5) Terminate Program"
1530 A%=0:PRINTTAB(T)"Select Function You Desire";:INPUTA%:IFA%<1ORA%>5GOTO1510
1540 ONA%GOTO1560,1760,3340,3370,3520
1550 !    ADD DATA TO FILE
1560 GOSUB202:IFSIZE(1)>1GET1RECORDRECPUT(1)-1X,R%,X$,X$,X$:PUTSEEK(1)=RECPUT(1)-1
1570 X%=40:J%=0:S$="A":GOSUB410:PRINTTAB(T)"Enter (A) Album, (S) Single or \ to End Data Entry";:A$="":INPUTA$:IFA$<>"A"ANDA$<>"S"
     ANDA$<>B$GOTO1570
1580 IFA$=B$GOSUB320:GOTO1510
1590 IFA$="S"GOTO1680
1600 J%=1:GOSUB410:R%=R%+1:PRINTTAB(T)"Album Number";R%:PRINT
1610 A$="":PRINTTAB(T)"Enter Album TITLE":PRINT:PRINTTAB(T);:GOSUB240:INPUTA$:IFA$=""GOTO1630
1620 C$=A$
```

More →

Program listing continued.

```
1630 A$="":PRINT:PRINTTAB(T)"Enter Album ARTIST":PRINT:PRINTTAB(T);:GOSUB240:INPUTA$:IFA$=""GOTO1660
1640 R$=A$:M=0:J$=FMT(R%,"99")+"000":GOSUB300:GOTO1680
1650 !   ENTRY POINT FOR START OF SIDE
1660 IFS$="B"GOTO1570
1670 IFS$="A"S$="B"
1680 GOSUB410:B=0:PRINTTAB(T)"Beginning of entry for side ";S$:PRINTTAB(T)"Enter \ FOR TITLE when done with side":PRINT
1690 PRINTTAB(T)"Enter TITLE":PRINT:PRINTTAB(T);:GOSUB240:INPUTC$:IFC$=B$GOTO1660
1700 A$="":PRINT:PRINT"Last Artist Entered is ";R$:PRINT:PRINT"Enter only a RETURN to use this Artist or Enter New Artist":PRINT:P
     RINTTAB(T);:GOSUB240:INPUTA$:IFA$=""GOTO1720
1710 R$=A$
1720 M=0:N=0:PRINT:PRINTTAB(T)"Enter TIME for this band (Minutes (Space) Seconds";:INPUTM,N:M=M*B%+N:IFM=0GOTO1690
1730 T%=R%:IFJ%=0T%=J%
1740 B=B+1:J$=FMT(T%,"99")+S$+FMT(B,"99"):GOSUB300:GOSUB410:GOTO1690
1750 !   CALCULATE TIMING
1760 GOSUB202:GOSUB410:IFSIZE(1)<1PRINTTAB(T)"Nothing In File ";:GOSUB550:ATTRS(1)=F:CLOSE1:GOTO1760
1770 PRINTTAB(T)"Reading File Into Memory":S%=1:M%=0:K=0:FORI=1TOSIZE(1)-1:GET1C%,M,J$,C$,R$:IFRIGHT$(J$,2)="00"K=K+1:B$(K)=J$:D$(
     K)=C$:G$(K)=R$:GOTO1790
1780 C%(S%)=C%:M%(S%)=M:M%=M%+M:J$(S%)=J$:C$(S%)=C$:R$(S%)=R$:S%=S%+1
1790 NEXTI:S%=S%-1
1800 GOSUB410:PRINTTAB(T)S%;"Bands/Titles in File":PRINT:GOSUB610:PRINTTAB(T);:GOSUB550
1810 D=0:GOSUB410:PRINTTAB(T)"Enter Time (up to 10 seconds) to be added to each band":PRINTTAB(T)"for allowance between tracks of
     record":PRINTTAB(T);:INPUTD:IFD>10GOTO1810
1820 FORK=1TOS%:M%(K)=M%(K)+D:M%=M%+D:NEXTK
1830 GOSUB410:PRINTTAB(T)"New Timing is;":PRINT:GOSUB610:PRINTTAB(T);:GOSUB550
1840 T%=0:GOSUB410:PRINTTAB(T)"Enter Time For ONE SIDE of Tape (Minutes ONLY)";:INPUTT%:T%=T%*B%:IFT%=0GOTO1840
1850 GOSUB410:IFT%>=M%(0)GOTO1890
1860 PRINTTAB(T)"Tape is too short for records. Do you wish to delete":PRINTTAB(T)"some titles";:GOSUB560:IFA$="Y"GOTO3170
1870 PRINT:PRINTTAB(T)"Do you wish to increase length of tape";:GOSUB560:IFA$="Y"GOTO1840
1880 GOTO1510
1890 PRINTTAB(T)"Do you wish to delete selections";:GOSUB560:IFA$="Y"GOTO3170
1900 !   CALCULATE RECORDINGS
1910 !   MENU FOR CALCULATION SELECTION
1920 GOSUB410:A$="TIMING BALANCE METHODS AVAILABLE":PRINTTAB(FNA(A$))A$:PRINT
1930 PRINT" 1) BALANCE PER INPUT/ALBUM SEQUENCE - Fill side 1 of tape,":PRINTTAB(4)"Balance on side 2 of tape.":PRINT
1940 PRINT" 2) BALANCE PER INPUT/ALBUM SEQUENCE - Side 1 longer but":PRINTTAB(4)"balanced to side 2 - May have some leftover tape
     if timing is shorter":PRINTTAB(4)"than tape length.":PRINT
1950 PRINT" 3) BALANCE REGARDLESS OF SEQUENCE - Closest balance possible.":PRINTTAB(4)"Side 1 longer, each side in album order if
     possible.":PRINT
1960 PRINTTAB(T)"Select Balance Method You Desire";:A%=0:INPUTA%:IFA%<1ORA%>3GOTO1920
1970 ONA%GOTO2040,2190,2400
1980 !
1990 !   C$(X), N%(X) = CODE AND POINTERS FOR SIDE 1 OF TAPE
2000 !
2010 !   R$(X), H%(X) = CODE AND POINTERS FOR SIDE 2 OF TAPE
2020 !
2030 !   BALANCE PER ALBUM SEQUENCE - FILL SIDE 1
2040 F%=0:G%=0:W%=0:FORI=1TOS%:IFW%=0ANDF%+M%(I)<=T%F%=F%+M%(I):NEXTI:W%=S%:GOTO2100
2050 !   SET W% TO START ELEMENT FOR SIDE 2
2060 IFW%=0W%=I
2070 !   ACCUM SIDE 1 IN F%, SIDE 2 IN G%
2080 G%=G%+M%(I):NEXTI
2090 !   CHECK TO SEE WE'RE STILL ON THE TAPE
2100 IFG%>T%GOSUB410:D%=M%:M%=G%-T%:GOSUB180:M%=D%:PRINTTAB(T)"OVER TAPE LENGTH BY";M;"MIN AND";S;"SEC":PRINT:PRINTTAB(T);:GOSUB55
     0:GOTO3180
2110 FORI=1TOB%:C$(I)="":R$(I)="":N%(I)=0:H%(I)=0:NEXTI
2120 !   PLACE SIDE 1 DATA IN C$(X) ARRAY, SIDE 2 IN R$(X) ARRAY
2130 J=W%-1:FORI=1TOJ:IFLEFT$(J$(I),1)<>B$C$(I)=J$(I):N%(I)=C%(I)
2140 NEXTI:IFW%=S%GOTO2170
2150 FORI=W%TOS%:IFLEFT$(J$(I),1)<>B$R$(I-J)=J$(I):H%(I-J)=C%(I)
2160 NEXTI
2170 GOTO2930
2180 !   BALANCE SIDES - ALBUM SEQUENCE
2190 F%=0:G%=0:W%=0:M%(0)=M%*.5:FORI=1TOS%:IFW%=0ANDF%+M%(I)<=M%(0)F%=F%+M%(I):NEXTI:GOTO2260
2200 !   SET W% TO START ELEMENT FOR SIDE 2
2210 IFW%=0W%=I
2220 !   ACCUM TIME FOR SIDE 2 IN G%, SIDE 1 IN F%
2230 G%=G%+M%(I)
2240 NEXTI
2250 !   CHECK TO SEE THAT WE'RE STILL ON THE TAPE
2260 IFMAX(F%,G%)>T%GOSUB410:D%=M%:M%=MAX(F%,G%)-T%:GOSUB180:M%=D%:PRINTTAB(T)"OVER TAPE LENGTH BY";M;"MIN AND";S;"SEC":PRINT:PRIN
     TTAB(T);:GOSUB550:GOTO3180
2270 !   PLACE SIDE 1 DATA IN C$(X) ARRAY, SIDE 2 IN R$(X) ARRAY
2280 FORI=1TOB%:C$(I)="":R$(I)="":N%(I)=0:H%(I)=0:NEXTI
2290 J=W%-1:FORI=1TOJ:IFLEFT$(J$(I),1)<>B$C$(I)=J$(I):N%(I)=C%(I)
2300 NEXTI
2310 FORI=W%TOS%:IFLEFT$(J$(I),1)<>B$R$(I-J)=J$(I):H%(I-J)=C%(I)
2320 NEXTI:IFF%>=G%GOTO2380
2330 !   IF SIDE 2 IS LONGER, SWAPS SIDE 1 WITH SIDE 2
2340 GOSUB410:PRINTTAB(T)"Side 2 is longer than Side 1 by";G%-F%;"seconds":PRINTTAB(T)"Do you wish to swap recordings now on Side
     2 with those"
2350 PRINTTAB(T)"on Side 1 so side 1 is longer";:GOSUB560:IFA$="N"GOTO2380
2360 !   THIS LINE DOES THE SWAPPING
2370 FORI=1TOS%:C$=C$(I):N%=N%(I):C$(I)=R$(I):N%(I)=H%(I):R$(I)=C$:H%(I)=N%:NEXTI
2380 GOTO2930
2390 !   BALANCE REGARDLESS OF ANY SEQUENCE
2400 FORI=1TOB%:C$(I)=Z$:R$(I)=Z$:N%(I)=0:H%(I)=0:NEXTI
2410 !   GET TIMING INTO ARRAY FOR MANIPULATION AND SORTING
2420 C=0:FORI=1TOS%:IFLEFT$(J$(I),1)=B$GOTO2440
2430 C$(I)=FMT(M%(I),Z$):C=C+M%(I):N%(I)=C%(I)
2440 NEXTI:GOSUB3540
2450 !   FIND HIGH END OF ACTIVE INFORMATION
2460 FORI=1TOS%:IFC$(I)=Z$I=I-1:GOTO2490
2470 NEXTI
2480 !   SPLIT FOR SIDES OF TAPE, REFERENCE TO HALF OF TOTAL TIME
2490 H%=I:F%=0:FORI=H%TO1STEP-1:IFC$(I)<>Z$ANDVAL(C$(I))+F%<C*.5 R$(I)=C$(I):H%(I)=N%(I):C$(I)=Z$:N%(I)=0:F%=F%+VAL(R$(I))
2500 NEXTI
2510 !   GET TOTAL TIME PER SIDE - P=ACCUM C$(X), Q=ACCUM R$(X)
2520 P=0:Q=0:FORI=1TOH%:IFC$(I)<>Z$P=P+VAL(C$(I))
2530 IFR$(I)<>Z$Q=Q+VAL(R$(I))
2540 !   SET R FOR DIFFERENCE BETWEEN SIDES
2550 NEXTI:S=MAX(P,Q)-MIN(P,Q):IFS=RORP=QGOTO2660
2560 R=S:IFP<QGOTO2620
2570 !   P>Q COMPARE AND RESHUFFLE
2580 FORI=H%TO1STEP-1:IFVAL(C$(I))>RGOTO2600
2590 R$(I)=C$(I):H%(I)=N%(I):C$(I)=Z$:N%(I)=0
2600 NEXTI:GOTO2520
2610 !   Q>P COMPARE AND RESHUFFLE
2620 FORI=H%TO1STEP-1:IFVAL(R$(I))>RGOTO2640
2630 C$(I)=R$(I):N%(I)=H%(I):R$(I)=Z$:H%(I)=0
2640 NEXTI:GOTO2520
2650 !   CHECK TO SEE WE'RE STILL ON THE TAPE
2660 IFMIN(P,Q)<>0ANDMAX(P,Q)<=T%GOTO2710
2670 IFMIN(P,Q)=0PRINTTAB(T)"CANNOT BALANCE SIDES - MUST DELETE SELECTION":GOTO2690
```

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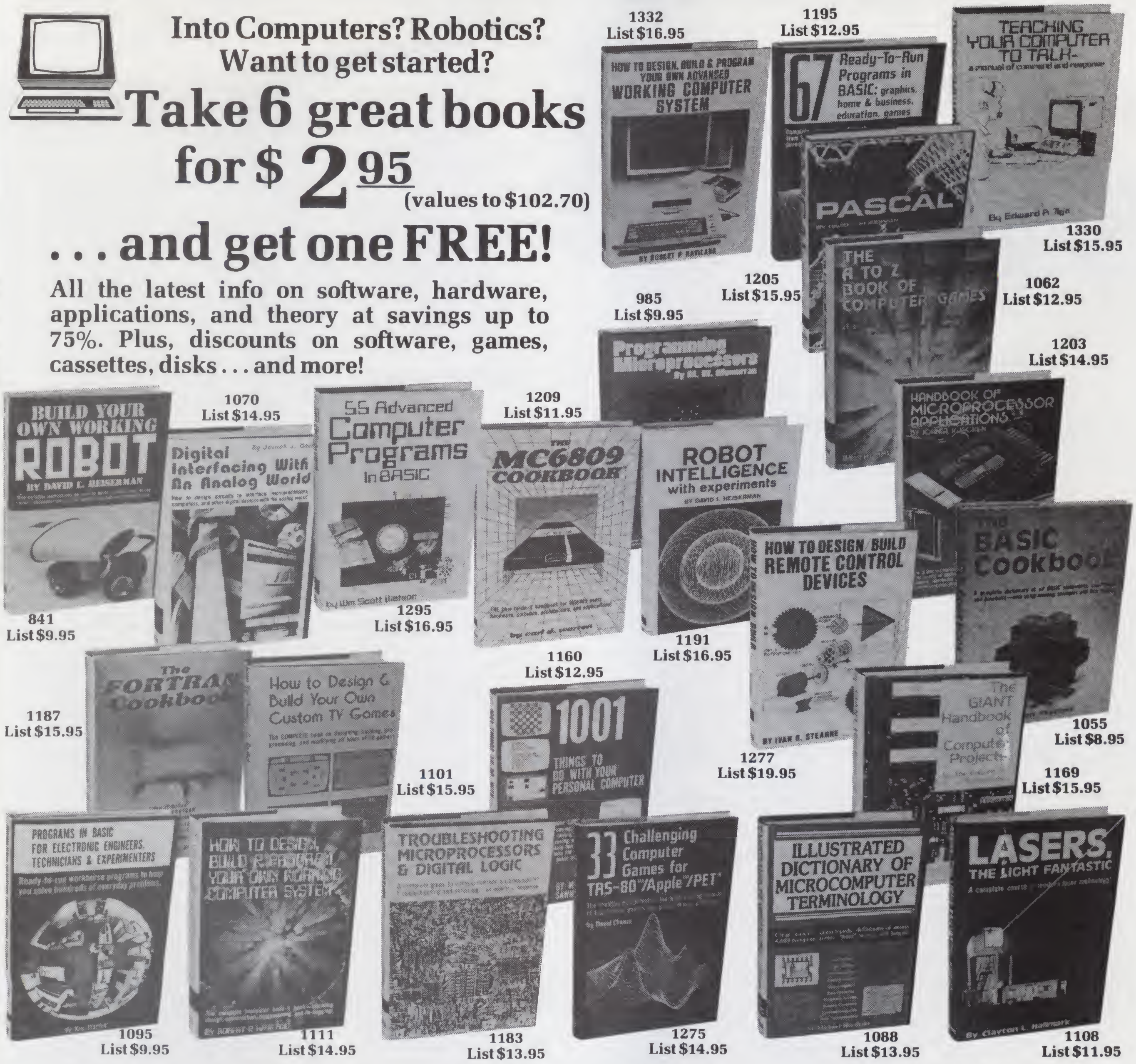
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Program continued.

```
2680 D%=M%:M%=MAX(P,Q)-T%:GOSUB180:M%=D%:PRINTTAB(T)"OVER TAPE LENGTH BY";M;"MIN AND";S;"SECONDS"
2690 PRINT:PRINTTAB(T)"Restarting system by reading file.":PRINT:PRINTTAB(T);:GOSUB550:CLOSE1:GOTO1760
2700 !   SORT BOTH ARRAYS
2710 GOSUB3540:GOSUB3640
2720 !   MOVE J$(X) DATA INTO C$ AND R$ ARRAYS
2730 FORI=1TOB%:IFC$(I)=Z$C$(I)="\\\":N%(I)=0:GOTO2760
2740 FORJ=1TOS%:IFN%(I)=C%(J)C$(I)=J$(J):GOTO2760
2750 NEXTJ
2760 NEXTI
2770 FORI=1TOB%:IFR$(I)=Z$R$(I)="\\\":H%(I)=0:GOTO2800
2780 FORJ=1TOS%:IFH%(I)=C%(J)R$(I)=J$(J):GOTO2800
2790 NEXTJ
2800 NEXTI
2810 !   SWAP IF SIDE 2 IS LONGER THAN SIDE 1
2820 IFP>QGOTO2850
2830 FORI=1TOS%:C$=C$(I):N%=N%(I):C$(I)=R$(I):N%(I)=H%(I):R$(I)=C$:H%(I)=N%:NEXTI
2840 !   SORT BY ALBUM
2850 GOSUB3640:GOSUB3540
2860 !   REPLACE \ WITH BLANK
2870 FORI=1TOB%:IFC$(I)="\\\"C$(I)=""
2880 IFR$(I)="\\\"R$(I)=""
2890 NEXTI
2900 !   EXIT TO PRINT ROUTINE
2910 GOTO2930
2920 !   PRINT ROUTINES
2930 X$="":GOSUB410:PRINTTAB(T)"Enter Title for Tape";:INPUTW$:OPEN9"*P"PAGESIZE64ENDPAGE3100:GOSUB410:PRINTTAB(T)"Set up Printer
     - Press RETURN When Ready";:INPUTA:GOSUB3120
2940 A=0:B=0:PUT9"Side One":PUT9
2950 M%=0:FORI=1TOS%:IFN%(I)=0GOTO3010
2960 B=VAL(LEFT$(C$(I),2)):IFB<1GOTO2990
2970 IFB=AGOTO2990
2980 A=B:PUT9TAB(5)LEFT$(B$(A),2);TAB(8)D$(A);TAB(49)G$(A)
2990 GET1RECORDN%(I)A%,C%,A$,C$,R$:M%=M%+C%+D:PUT9LEFT$(C$(I),2);TAB(4)MID$(C$(I),3,1);TAB(8)RIGHT$(C$(I),2);TAB(13)C$;:IFX$=R$PUT
     9:GOTO3010
3000 PUT9"   ";R$:X$=R$
3010 NEXTI:M%=M%-D:GOSUB180:PUT9TAB(10)"Total Time Side One = ";FMT(M,"Z9:")+FMT(S,"99"):PUT9REPEAT$(CHAR$(61),80)
3020 A=0:B=0:PUT9"Side Two":PUT9
3030 M%=0:FORI=1TOS%:IFH%(I)=0GOTO3090
3040 B=VAL(LEFT$(R$(I),2)):IFB<1GOTO3070
3050 IFB=AGOTO3070
3060 A=B:PUT9TAB(5)LEFT$(B$(A),2);TAB(8)D$(A);TAB(49)G$(A)
3070 GET1RECORDH%(I)A%,C%,A$,C$,R$:M%=M%+C%+D:PUT9LEFT$(R$(I),2);TAB(4)MID$(R$(I),3,1);TAB(8)RIGHT$(R$(I),2);TAB(13)C$;:IFX$=R$PUT
     9:GOTO3090
3080 PUT9"   ";R$:X$=R$
3090 NEXTI:M%=M%-D:GOSUB180:PUT9TAB(10)"Total Time Side Two = ";FMT(M,"Z9:")+FMT(S,"99"):PUT9REPEAT$(CHAR$(61),80):ENDPAGE9:PUT9:P
     UT9:CLOSE9:ATTRS(1)=F:CLOSE1:GOTO1510
3100 PUT9:PUT9
3110 CLOSE9:OPEN9"*P"PAGESIZE64ENDPAGE3100
3120 PUT9:PUT9
3130 PUT9"Tape Title: ";W$;TAB(55)"Tape Time: ";FMT(T%\B%,"ZZ");" Minutes":PUT9
3140 PUT9"Al";TAB(4)"S";TAB(7)"Band";TAB(31)"Title":PUT9REPEAT$(CHAR$(61),80)
3150 RETURN
3160 !   DELETION ROUTINE
3170 GOSUB410:A$="Delete Titles From Array":PRINTTAB(FNA(A$))A$:PRINT:V%=0
3180 PRINTTAB(T)"All titles will be displayed. You may elect":PRINTTAB(T)"to retain or delete any title":PRINT:PRINTTAB(T);:GOSUB5
     50
3190 FORI%=1TOS%:IFLEFT$(J$(I%),1)=B$GOTO3310
3200 GOSUB410:PRINTTAB(T)"Timing is":PRINT:GOSUB610:PRINT:IFM%>T%*2D%=M%:M%=M%-(T%*2):GOSUB180:PRINTTAB(T)"Delete";M;"Minutes,";S;
     "Seconds or more":PRINT:M%=D%
3210 D%=M%:M%=M%(I%):GOSUB180:M%=D%:PRINTTAB(T)"Selection: ";TAB(T+12)C$(I%):PRINTTAB(T)"Artist: ";TAB(T+12)R$(I%):PRINTTAB(T)"Tim
     e:";TAB(T+12)FMT(M,"Z9:")+FMT(S,"99"):PRINT
3220 PRINT"Enter (D) to Delete, <CR> to Retain, (\) to End Delete Routine":PRINT"or (*) to Restart list from the beginning.";
3230 A$="":INPUTA$:IFA$=""GOTO3310
3240 IFA$=B$GOTO3320
3250 IFA$=CHAR$(42)GOTO3180
3260 IFA$<>"D"GOTO3200
3270 J$(I%)=B$+RIGHT$(J$(I%),4):V%=V%+1:M%=M%-M%(I%):M%(I%)=0
3280 !   M%=TOTAL TIME
3290 !   M%(0)=TOTAL TIME *.5
3300 !   T%=TIME PER SIDE OF TAPE
3310 NEXTI%:GOTO3190
3320 GOTO1920
3330 !   CHANGE FILE ATTRIBUTES TO PERMANENT
3340 GOSUB202:GOSUB410:PRINTTAB(T)"Changing File Attributes to WRITE PROTECT - PERMANENT"
3350 ATTRS(1)=3:CLOSE1:GOTO1510
3360 !   DELETE FILE FROM DISK
3370 GOSUB202:IFF=3GOSUB410:PRINTTAB(T)"PERMANENT FILE - ERASE";:GOSUB560:IFA$="N"CLOSE1:GOTO1510
3380 GOSUB410:PRINTTAB(T)"ERASING FILE - ";RIGHT$(N$,LEN(N$)-2):ATTRS(1)=0:CLOSE1:SCRATCHN$:GOTO1510
3390 !       VARIABLES USED IN INPUT ROUTINE AND FILES
3400 !   J%=0 FOR SINGLE, 1 FOR ALBUM
3410 !   R%=ALBUM NUMBER
3420 !   C$=ALBUM TITLE
3430 !   S$=SIDE - A OR B
3440 !   R$=ARTIST
3450 !   B%=BAND NUMBER
3460 !   M=TIME FOR BAND (IN SECONDS)
3470 !   D=SECONDS ADDED FOR TIME BETWEEN TRACKS
3480 !   FILE STRUCTURE - DATA RECORD
3490 !   RECORD#, TIME, CODE, TITLE, ARTIST
3500 !   FILE STRUCTURE - FINAL RECORD
3510 !   RECORD#, ALBUM#, DUMMY, DUMMY, DUMMY
3520 GOSUB410:A$="Program Terminated":PRINTTAB(FNA(A$))A$:PRINT:PRINT:END
3530 !   SORT FOR C$(X) AND N%(X)
3540 LO=(B%-A%)+1
3550 LO=INT(LO/2)
3560 IFLO=0RETURN
3570 FO=B%-LO:FORDO=A%TOFO:EO=DO+LO
3580 IFC$(DO)<=C$(EO)GOTO3620
3590 F$=C$(EO):HO=N%(EO):GO=DO
3600 C$(EO)=C$(GO):N%(EO)=N%(GO):EO=GO:GO=GO-LO:IFGO>A%-1THENIFC$(GO)>F$GOTO3600
3610 C$(EO)=F$:N%(EO)=HO
3620 NEXTDO:GOTO3550
3630 !   SORT FOR R$(X) AND H%(X)
3640 LO=(B%-A%)+1
3650 LO=INT(LO/2)
3660 IFLO=0RETURN
3670 FO=B%-LO:FORDO=A%TOFO:EO=DO+LO
3680 IFR$(DO)<=R$(EO)GOTO3720
3690 F$=R$(EO):HO=H%(EO):GO=DO
3700 R$(EO)=R$(GO):H%(EO)=H%(GO):EO=GO:GO=GO-LO:IFGO>A%-1THENIFR$(GO)>F$GOTO3700
3710 R$(EO)=F$:H%(EO)=HO
3720 NEXTDO:GOTO3650
```

Line 1840 requests the time for one side of the tape you're going to use and measures the total record time against this figure. If the total record time is longer you may elect to increase the tape time or delete some of the selections. You may also choose to delete entries even though you're within the tape time limitation.

The deletion routine in lines 3160–3320 is easy to understand in that it presents each selection on the console in the order of entry and lets you retain or delete any of them. The time shown as that necessary for deletion is based only on the assumption that all remaining selections will fit on the tape. This is usually a false assumption and you'll probably have to delete one or two more to have it fit. The correct total recording time is entirely dependent on the number of remaining entries, the time of each entry and the method of balancing you choose.

Three methods of balancing are provided, each with its own balancing routine. One thing common between them is at this point the coded record data is in the C$(X) array and the disk file record pointers in the N%(X) array. After balancing, the C$(X)–N%(X) pair will hold those for side one of the tape and the R$(X)–H%(X) pair will hold the data for side two.

Method one (see Sample 1) attempts to fill side one of the tape with as many complete selections as possible, leaving the remaining selections for side two. This is done without altering the sequence of the selections from their original entry sequence, except for the deletions, which are not considered in this balance.

The loop in lines 2040–2080 accumulates the time for each selection in variable F% until such time that it may exceed the length for one side of the tape (T%). At that time subsequent passes will accumulate time in G%. W% becomes the pointer for the starting element for side two. After checking that the total time per side is still within the tape time (line 2100), the selections for each side of the tape are placed into the proper arrays, using the routine in lines 2120–2160. Operation is then transferred to the print routine in line 2930.

Method two (Sample 2) attempts to balance the time on each side without losing the original sequence of the selections. This will result in side one being longer than side two, but with the minimum amount of dead space at the end of side one and the beginning (or end) of side two. This will allow you to splice off the end of the tape for a more professional recording.

The routine in lines 2180–2380 does the balancing and operates in a similar fashion to method one. The main difference is that the time for side one is compared to half the total recording time instead of half the total tape time. This will result in the closest balance possible without altering the sequence.

As it's possible for side two to be longer than side one using this method, the routine in lines 2330–2370 provides an elective means of swapping the selections from side one with those of side two.

Method three (Sample 3) uses the routines in lines 2390–2910 and the sort subroutines in lines 3530–3720. This routine will give you the best possible time balance between both sides of the tape at the expense of changing the sequence of the selections. Since much sorting and data manipulation is required, this tends to be the method taking longest to complete its task.

This method differs from those preceding in that it uses the individual recording times for each selection instead of accumulated time to perform its balance. For this reason, the routine in lines 2410–2440 is used to

```
Al S  Band                        Title
============================================================================
Side One

     01 SARAH VAUGHAN, RECORDED LIVE - VOL 1      SARAH VAUGHAN
01 A   01   SEPTEMBER IN THE RAIN   SARAH VAUGHAN
01 A   02   JUST ONE OF THOSE THINGS
01 A   03   BE ANYTHING (BUT BE MINE)
01 A   05   STAIRWAY TO THE STARS
01 B   01   LIKE SOMEONE IN LOVE
01 B   02   SPEAK LOW
01 B   04   I'LL STRING ALONG WITH YOU
     02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A   01   THANKS FOR THE MEMORY
02 A   03   MISTY
02 A   04   WHAT IS THIS THING CALLED LOVE
         Total Time Side One = 44:28
============================================================================
Side Two

     02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A   05   LOVER MAN
02 B   01   SOMETIMES I'M HAPPY
02 B   02   SASSY'S BLUES
02 B   03   POLKA DOTS AND MOONBEAMS
02 B   04   I CRIED FOR YOU
00 A   01   NIGHT TRAIN   EARL BOSTIC
         Total Time Side Two = 26:05
============================================================================
```

Sample 1. Entering recordings onto tape (method 1).

```
Al S  Band                        Title
============================================================================
Side One

     02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A   01   THANKS FOR THE MEMORY   SARAH VAUGHAN
02 A   02   I FEEL PRETTY
02 A   03   MISTY
02 A   04   WHAT IS THIS THING CALLED LOVE
02 A   05   LOVER MAN
02 B   01   SOMETIMES I'M HAPPY
02 B   02   SASSY'S BLUES
02 B   03   POLKA DOTS AND MOONBEAMS
02 B   04   I CRIED FOR YOU
00 A   01   NIGHT TRAIN   EARL BOSTIC
         Total Time Side One = 43:46
============================================================================
Side Two

     01 SARAH VAUGHAN, RECORDED LIVE - VOL 1      SARAH VAUGHAN
01 A   01   SEPTEMBER IN THE RAIN   SARAH VAUGHAN
01 A   02   JUST ONE OF THOSE THINGS
01 A   03   BE ANYTHING (BUT BE MINE)
01 A   04   THOU SWELL
01 A   05   STAIRWAY TO THE STARS
01 A   06   HOW HIGH THE MOON
01 B   01   LIKE SOMEONE IN LOVE
01 B   02   SPEAK LOW
01 B   03   THREE LITTLE WORDS
01 B   04   I'LL STRING ALONG WITH YOU
01 B   05   ALL OF YOU
         Total Time Side Two = 42:53
============================================================================
```

Sample 2. Method 2.

move the timing data into the C$(X)–N%(X) pair for processing.

Once the arrays are loaded, operation is transferred to the sort subroutine in lines 3530–3620, and the C$(X) array is sorted in ascending order. Since the deleted entries are now clustered at the high end of the array, the loop in lines 2450–2470 can set H% as the pointer for the highest active array element.

The loop in lines 2480–2500 approximates half the total recording time with some selections and moves the remaining selections into the R$(X)–H%(X) pair. The reentrant routine in lines 2510–2560 calculates the total time per side and determines the longest side and the time differential. The time difference is retained in variable R.

Depending upon which side is the longest, operation will transfer to routines in lines 2570–2600 or 2610–2640. These routines will try to find elements of both arrays they can swap that will result in a smaller time differential. The routine in line 2520 is reentered until variable R can no longer be reduced with additional swapping or an exact balance is achieved.

Lines 2650–2690 check for timing errors, and if they exist, the file must be read again and the process repeated. This is because the C$(X) array no longer has the data required for the deletion routine or for method one or two operation.

Once these tests have been passed, the arrays are sorted so any open elements freed by the swapping operation will once again appear in the highest array elements. Lines 2720–2800 move the proper data back into the arrays. Note that three backslashes (\\\) replace the data for those entries that are not included on the tape. This is done so the entries will sort properly when called in line 2850. The backslashes will be replaced with a single blank in lines 2860–2890.

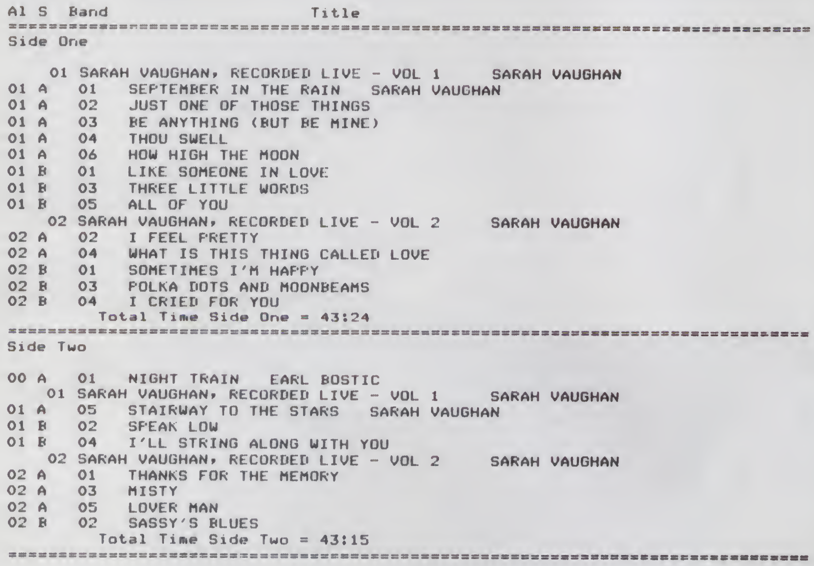
If side one is shorter than side two, the records will be swapped as in method two; however, this will be done automatically since there is no need for an operator decision when using this method.

Printing the Report

The print routine in lines 2920–3150 is straightforward and shouldn't be too hard to convert to other BASICs. After printing the heading, all data pertaining to side one of the tape is printed first, followed by the data for side two. The total time for each side is also printed. The resultant report will become your guide for the recording operation and can be retained for your tape catalog.

The total time per side includes the time (space) you elected to use between selections and will not agree with the total of the individual recording times as entered.

Worthy of note is that Micropolis BASIC allows you to define the printer or console as a file. Such is the case in lines 2930 and 3110 where the printer is defined as file #9.



```
Al S  Band                       Title
==============================================================================
Side One

     01 SARAH VAUGHAN, RECORDED LIVE - VOL 1      SARAH VAUGHAN
01 A    01   SEPTEMBER IN THE RAIN   SARAH VAUGHAN
01 A    02   JUST ONE OF THOSE THINGS
01 A    03   BE ANYTHING (BUT BE MINE)
01 A    04   THOU SWELL
01 A    06   HOW HIGH THE MOON
01 B    01   LIKE SOMEONE IN LOVE
01 B    03   THREE LITTLE WORDS
01 B    05   ALL OF YOU
     02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A    02   I FEEL PRETTY
02 A    04   WHAT IS THIS THING CALLED LOVE
02 B    01   SOMETIMES I'M HAPPY
02 B    03   POLKA DOTS AND MOONBEAMS
02 B    04   I CRIED FOR YOU
          Total Time Side One = 43:24
==============================================================================
Side Two

00 A    01   NIGHT TRAIN   EARL BOSTIC
     01 SARAH VAUGHAN, RECORDED LIVE - VOL 1      SARAH VAUGHAN
01 A    05   STAIRWAY TO THE STARS   SARAH VAUGHAN
01 B    02   SPEAK LOW
01 B    04   I'LL STRING ALONG WITH YOU
     02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A    01   THANKS FOR THE MEMORY
02 A    03   MISTY
02 A    05   LOVER MAN
02 B    02   SASSY'S BLUES
          Total Time Side Two = 43:15
==============================================================================
```

Sample 3. Method 3.

File Attributes

Micropolis BASIC allows for setting and changing the write protect and erase protect features of any file within a program. This function, although nice to have, isn't required for the operation of the program. If your BASIC doesn't support such a function, all routines and references to them (ATTR and ATTRS) can be removed from the program without harm to its operation.

Conversion Aids

To assist in converting this program to your BASIC, I offer the following definitions of some of the less common statements and keywords used in the program.

- ATTR—Returns the attributes of a file.
- ATTRS(X)—Sets the attributes of a file.
- ENDPAGE—A statement that gives BASIC a line number to GOSUB when the logical end of a page has been reached. Also pages to the end of the logical page when used as a statement.
- ERR, ERR$ and ERROR—Error trapping and printing commands.
- GET—Read a record from a file.
- PAGESIZE—Sets the logical page size for print routines.
- PUT—Write a record to a file.
- PUTSEEK—Set the sequential record pointer for a file.
- RECORD—The random access record number for a GET or PUT.
- RECPUT—Returns the position of the sequential PUT pointer.
- REPEAT$—Repeats a string n times.
- SIZE—Returns the number of records in a file.

The other keywords and statements should be familiar to those programming with extended disk BASIC, offering very few problems in the conversion.

Operation

Since the program is fully prompted, it should not be hard to operate. Upon initialization the system will default to the file creation routine because the file will not be in existence on the disk. From that point on everything should be routine. Remember that nothing is ever deleted from the file so you don't need to reenter existing data when trying different mixes of music. ■

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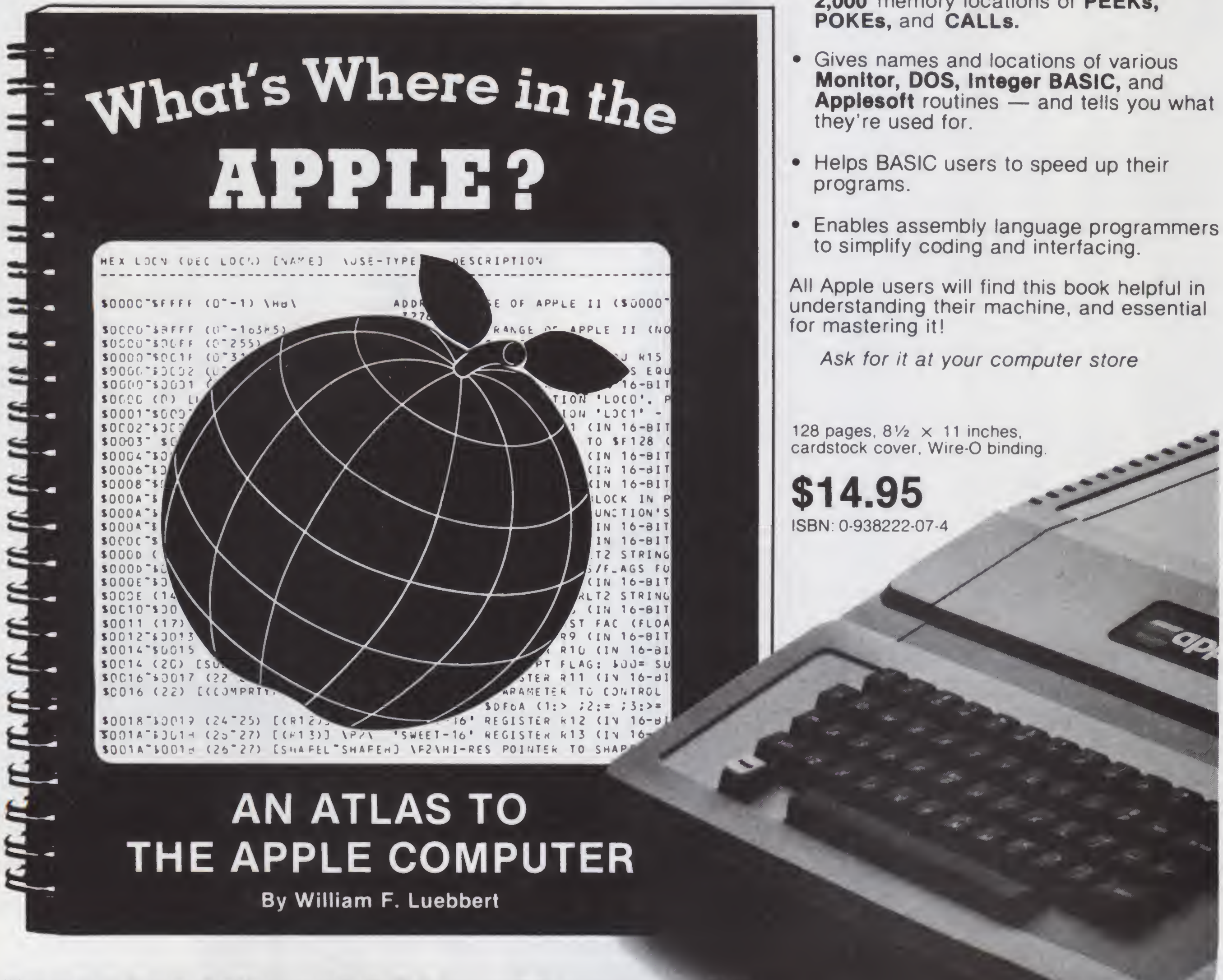

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74LS04	.25	74LS132	.75	74LS273	1.60
74LS05	.25	74LS136	.50	74LS275	3.30
74LS08	.30	74LS138	.75	74LS279	.50
74LS09	.25	74LS139	.75	74LS280	1.95
74LS10	.25	74LS145	1.10	74LS283	.95
74LS11	.30	74LS147	2.25	74LS290	1.20
74LS12	.30	74LS148	1.25	74LS293	1.80
74LS13	.40	74LS151	.75	74LS295	1.00
74LS14	.75	74LS153	.75	74LS298	.95
74LS15	.30	74LS155	.90	74LS299	2.50
74LS20	.25	74LS156	.90	74LS323	3.95
74LS21	.30	74LS157	.75	74LS324	1.75
74LS22	.25	74LS158	.75	74LS347	1.95
74LS26	.30	74LS160	.90	74LS348	1.95
74LS27	.35	74LS161	.90	74LS352	1.50
74LS28	.35	74LS162	.90	74LS353	1.50
74LS30	.25	74LS163	.90	74LS363	1.35
74LS32	.35	74LS164	.90	74LS365	.90
74LS35	.55	74LS165	.90	74LS366	.90
74LS37	.50	74LS166	2.00	74LS367	.65
74LS38	.35	74LS168	1.70	74LS368	.65
74LS40	.25	74LS169	1.70	74LS373	1.15
74LS42	.50	74LS170	1.70	74LS374	1.75
74LS47	.75	74LS173	.75	74LS375	.65
74LS48	.75	74LS174	.90	74LS377	1.40
74LS49	.75	74LS175	.90	74LS385	1.85
74LS51	.25	74LS181	2.10	74LS386	.60
74LS54	.35	74LS189	9.95	74LS390	1.85
74LS55	.35	74LS190	.95	74LS393	1.85
74LS63	1.20	74LS191	.95	74LS395	1.60
74LS73	.35	74LS192	.80	74LS399	1.65
74LS74	.40	74LS193	.90	74LS424	2.95
74LS75	.50	74LS194	.95	74LS447	.35
74LS76	.40	74LS195	.90	74LS490	1.90
74LS78	.50	74LS196	.80	74LS630	75.00
74LS83	.75	74LS197	.80	74LS640	3.00
74LS85	1.10	74LS221	1.15	74LS641	3.00
74LS86	.40	74LS240	1.15	74LS642	3.00
74LS90	.60	74LS241	1.15	74LS645	3.00
74LS91	.80	74LS242	1.85	74LS668	1.65
74LS92	.65	74LS243	1.85	74LS669	1.85
74LS93	.60	74LS244	1.00	74LS670	2.15
74LS95	.80	74LS245	1.95	74LS674	9.60
74LS96	.80	74LS247	.75	74LS682	3.15
74LS107	.40	74LS248	1.20	74LS683	2.25
74LS109	.40	74LS249	.95	74LS684	2.35
74LS112	.40	74LS251	1.25	74LS685	2.35
74LS113	.40	74LS253	.80	74LS688	2.35
74LS114	.50	74LS257	.80	74LS689	2.35
74LS122	.45	74LS258	.80		

74S00

74S00	.40	74S163	3.70
74S02	.45	74S168	4.60
74S03	.45	74S169	5.40
74S04	.75	74S174	1.05
74S05	.75	74S175	1.05
74S08	.45	74S181	4.45
74S09	.75	74S182	2.90
74S10	.65	74S188	3.90
74S11	.80	74S189	14.90
74S15	.65	74S194	2.90
74S20	.65	74S195	1.85
74S22	.75	74S196	4.85
74S30	.45	74S197	4.20
74S32	.95	74S201	14.90
74S37	1.85	74S225	8.90
74S38	1.65	74S240	3.95
74S40	.40	74S241	3.70
74S51	.75	74S251	1.85
74S64	.75	74S253	7.40
74S65	1.20	74S257	1.35
74S74	.65	74S258	1.45
74S85	2.35	74S260	1.80
74S86	1.40	74S274	19.90
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74S114	1.45	74S287	4.70
74S124	2.75	74S288	4.40
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74S134	.65	74S373	3.40
74S135	1.45	74S374	3.40
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74S158	1.40	74S482	15.50
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74S162	3.70	74S572	7.75

74C00 CMOS

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74C02	.35	74C221	2.20
74C04	.35	74C240	2.20
74C08	.35	74C244	2.20
74C10	.35	74C373	2.70
74C14	1.45	74C374	2.70
74C20	.35	74C901	.80
74C30	.35	74C902	.80
74C32	.50	74C903	.80
74C42	1.70	74C904	.80
74C48	2.05	74C905	10.90
74C73	.65	74C906	.90
74C74	.85	74C907	.90
74C76	1.90	74C908	2.00
74C83	1.90	74C909	2.70
74C86	.90	74C910	9.90
74C89	4.50	74C911	9.90
74C90	1.70	74C912	9.90
74C93	1.70	74C914	1.90
74C95	1.70	74C915	1.90
74C107	.95	74C917	2.70
74C150	5.70	74C918	1.90
74C151	2.20	74C920	16.00
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4012	.35	4050	.55	4512	.95
4013	.45	4051	.95	4514	2.25
4014	.95	4052	.95	4515	2.25
4015	.95	4053	.95	4516	1.50
4016	.45	4055	2.75	4518	1.25
4017	.95	4056	2.75	4519	1.25
4018	.95	4059	9.95	4520	1.25
4019	.45	4060	1.25	4522	1.25
4020	.95	4066	.75	4526	1.25
4021	.95	4068	.40	4527	1.75
4022	.95	4069	.40	4528	1.25
4023	.35	4070	.40	4531	.95
4024	.75	4071	.30	4532	1.75
4025	.35	4072	.30	4539	1.75
4026	1.95	4073	.30	4543	1.95
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4029	.95	4078	.50	4556	.95
4030	.45	4081	.40	4558	2.25
4031	1.50	4082	.40	4568	5.95
4032	2.75	4085	.95	4581	1.95
4033	2.75	4086	.95	4582	1.95
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Bubble vs straight insertion vs quick. When do you use them and which one is best?

Sorting Techniques Explained

By H.S. Gentry

If you write software for any type of computer, sooner or later you'll need to sort data. Some sorting techniques are better than others, but why? When do you use the various techniques? Is any one technique good enough to use as your standard sorting algorithm? Here's a rundown of the different kinds of sorting, and their applications.

The Bubble Sort

I learned the bubble sort technique first. It's called that because the elements that belong at the top of the list "bubble" up with each pass through the algorithm.

Using the bubble sort is simple. You go through the list n times (n is the number of items to be sorted), checking each item in the list with the next item and exchanging them if they aren't in the proper order. As you can see from Listing 1, this makes a very compact sorting program. Lines 1000–2000 do the actual sorting.

You can also see that the algorithm will always make n squared compares (n items checked n times). Thus, even if your data is already sorted (or nearly so), it will still take a long time to finish.

This algorithm can be improved with the addition of a flag to check for one complete pass through the data with no exchanges. When this condition is detected the data is sorted, no matter if this is the first or nth pass. Listing 2 is the same program changed to use this flag technique.

The bubble sort can be further modified to improve its performance, but there is another, better sorting algorithm.

The Straight Insertion Sort

The straight insertion sort is almost as easy to implement as the bubble sort, and will almost always give faster results. (The only exception is when the data to be sorted is already in sort.)

The straight insertion sort passes through the data one time, takes each element and looks back from its location to find where it belongs. For example, sort the following data in ascending order:

6 1 8 4 9 3

Start with the second item (1) and

```
10 DIM D(100)
15 REM - GENERATE 101 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 100
30 D(I)=RND(0)
40 NEXT I
1000 REM THIS IS THE BUBBLE SORT
1010 FOR I = 0 TO 100
1020 FOR L = 0 TO 100-1
1030 IF D(L) > D(L+1) THEN W=D(L): D(L)=D(L+1): D(L+1)=W
1040 NEXT L
1050 NEXT I
2000 REM THIS IS THE END OF BUBBLE SORT
9999 END
```

Listing 1. Simple bubble sort.

```
10 DIM D(100)
15 GENERATE 101 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 100
30 D(I)=RND(0)
40 NEXT I
1000 REM - THIS IS THE BUBBLE SORT WITH FLAG
1005 F=0
1010 FOR I = 0 TO 100
1020 FOR L = 0 TO 100-1
1030 IF D(L) > D(L+1) THEN W=D(L): D(L)=D(L+1): D(L+1)=W:F=1
1040 NEXT L
1050 IF F=0 THEN 2000 ELSE F=0: NEXT I
2000 THIS IS THE END OF BUBBLE SORT WITH FLAG
9999 END
```

Listing 2. Bubble sort with flag.

Address correspondence to H.S. Gentry, Route 1, Box 39B, Earlysville, VA 22936.

compare it to the first (6). If these two items are in order, go on to the next item. If they are not in order, which is the case here, then exchange them. We get:

1 6 8 4 9 3

Now move on to the third item (8). It's in order, so leave it alone and move on to the fourth (4). It's not in order; look back until you find the place it belongs. The result:

1 4 6 8 9 3

Repeat this for the last two items. You'll end up with:

1 3 4 6 8 9

Listing 3 is the straight insertion sort algorithm implemented in BASIC. Lines 1000–2000 are the actual sort. It's almost as easy as the bubble sort and much faster.

How much faster? The bubble sort algorithm with the flag took 210 seconds to sort 100 random numbers (on a TRS-80 Model I). It took 888 seconds to sort 200 random numbers. The straight insertion sort took 87 seconds to sort 100 numbers and 329 seconds to sort 200 numbers.

Quicksort

Until recently I used one of the above techniques to do all of my sorting, and then I learned about quicksort.

Quicksort was invented by C. A. R. Hoare. Unlike the bubble or straight insertion sort, quicksort is not exactly intuitive. That is, if I tried to think of a way to sort data, the quicksort algorithm would not come to mind.

Quicksort works by selecting an item at random from the list to be sorted, and then partitioning the data into two groups. One group has elements greater than the selected element and one group has elements less than the selected element. These two partitions are then subjected to this same algorithm, as are the four resulting partitions, and so on until each partition has only one element. At this time the data will be in sort.

Let's look at a simple example. Sort the following data in ascending order:

6 1 8 4 9 3

First pick an element at random; e.g., 4. Then start at the low end and at the high end, and exchange elements that are on the wrong side. You get:

3 1 8 4 9 6

Then:

3 1 4 8 9 6

Now you have two partitions:

3 1 4 and 8 9 6

Work on the 314 partition. Pick 1 as the test element and you get 1 and 3 4 as the two partitions. Work on 3 4 to get 3 and 4 as the two partitions. You now have four partitions:

1, 3, 4, 8 9 6

You must go back to 8 9 6 and work to get 6 8 and 9. Then:

6, 8, 9

Put all of this together and you have:

1, 3, 4, 6, 8, 9

and the data is sorted.

The hard part is keeping track of all of the partitions that result from each pass and making sure that all of them are processed. This can be done in two ways.

The hardest way is used in a programming language that does not allow recursive calls to subroutines. That is, a subroutine may not call itself. In this case you must keep

```
10 DIM D(1000)
15 REM - GENERATE 1001 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 1000
30 D(I)=RND(0)
40 NEXT I
1000 REM - THIS IS THE STRAIGHT INSERTION SORT
1100 FOR J = 1 TO 1000
1110 K=D(J)                              'FIND A PLACE FOR THIS ITEM
1120 FOR L = J-1 TO 0 STEP -1            'BACK UP UNTIL WE FIND PLACE
1130 IF K > D(L) THEN D(L+1)=K: GO TO 1200   TERMINATE LOOP
1140 REM - WHEN WE GET HERE THE LAST SLOT WAS NOT THE PLACE
1141 REM - SO WE WILL MOVE UP ONE PLACE
1150 D(L+1)=D(L)
1160 NEXT L                              'GO BACK TO TRY AGAIN
1161 REM - THE ABOVE LOOP WILL BE REPEATED UNTIL A PLACE IS
1162 REM - FOUND OR THE LOOP RUNS OUT.  IF THIS HAPPENS
1163 REM - THEN THE PROPER PLACE IS AT THE BEGINNING OF
1164 REM - THE LIST.
1180 D(0)=K                             'PUT IT AT THE TOP OF LIST
1200 NEXT J                             'ON TO NEXT ITEM TO BE SORTED
2000 REM - THIS IS THE END OF STRAIGHT INSERTION SORT
9999 END
```

Listing 3. Straight insertion sort.

```
5 REM - SL IS THE ARRAY STACK FOR THE LEFT PARTITION BOUND
6 REM - SR IS THE ARRAY STACK FOR THE RIGHT PARTITION BOUND
7 REM - S IS THE POINTER TO THE NEXT POSITION IN THE STACKS
10 DIM D(1000),SL(20),SR(20)
15 REM - GENERATE 1001 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 1000
30 D(I)=RND(0)
40 NEXT I
1000 REM - THIS IS NONRECURSIVE QUICKSORT
1004 REM - INITIALIZE THE STACKS WITH FIRST AND LAST TO START
1005 S=1: SL(1)=0: SR(1)=1000
1006 L=SL(S): R=SR(S): S=S-1   'POP TOP REQUEST FROM STACK
1007 REM - L=LEFT BOUND OF PARTITION TO BE PARTITIONED
1008 REM - R=RIGHT BOUND OF PARTITION TO BE PARTITIONED
1010 REM - NOW WE WILL PARTITION
1020      I=L:J=R
1030          X=D((I+J)/2)   'SELECT MIDDLE VALUE
1040               IF D(I) < D THEN I=I+1: GOTO 1040
1050               IF X < D(J) THEN J=J-1: GOTO 1050
1051 REM - THE LAST TWO LINES SELECTED AN ELEMENT IN THE
1052 REM - UPPER HALF THAT BELONGS IN THE LOWER AND IN THE
1053 REM - LOWER HALF THAT BELONGS IN THE UPPER
1056               IF I <= J THEN 1060 ELSE 1100
1060                   W=D(I):D(I)=D(J):D(J)=W  'EXCHANGE
1070                   I=I+1:J=J-1
1100           IF I>J THEN 1110 ELSE 1040
1110           IF I < R THEN S=S+1: SL(S)=I: SR(S)=R
1111 REM - THE LAST LINE PUSHED A PARTITION REQUEST ON THE
1112 REM - STACK. NOW WE WORK ON THE OTHER ONE.
1120           R=J
1130      IF L >= R THEN 1140 ELSE 1020
1139 REM - NOW WE SEE IF ANY REQUESTS ARE ON THE STACK
1140 IF S = 0 THEN 2000 ELSE 1006
2000 REM - THIS IS THE END OF QUICKSORT
9999 END
```

Listing 4. Nonrecursive sort.

track of each partition and make sure it is sorted. This is done with a stack (actually, two stacks). When you finish with each pass through the algorithm, you put the pointers to the right-most partition on the stacks and process the left partition again. When you work your way to the left end of the list, you pop a partition off the stack and start again. When no pointers remain on the stack, the data has been sorted.

When you pick the size for the stack, you must guess a little. If you're very lucky and the partitions split the data exactly in two every time, the stack must be only LOG(n) (n is the number of items to be sorted). If you're not so lucky and each makes the right partition (the one placed on the stack) one element, then the stack must be n long. Both of these conditions are almost impossible, and I find that a stack of a little more than LOG(n) works well. That is, for 1000 items to be sorted, a stack of 20 is more than enough.

```
       PROCEDURE SORT (L,R: INTEGER);
               VAR I,J,X/W: INTEGER;
       BEGIN I:=L; J:=R;
               X:= A!(L+R) DIV 2!;
               REPEAT
WHILE A!I!<X DO I:=I+1;
                       WHILE X<A!J! DO J:=J-1;
                       IF I<=J THEN
                       BEGIN W:=A!I!;
                               A!I!:=A!J!;
                               A!J!:=W
                               I:-I+1; J:=J-1;
                       END
               UNTIL I>J;
               IF I<J THEN SORT(L,J);
               IF I<R THEN SORT(I,R);
       END;
```

Listing 5. Recursive Quicksort written in Pascal.

```
5 REM - SL IS THE ARRAY STACK FOR THE LEFT PARTITION BOUND
6 REM - SR IS THE ARRAY STACK FOR THE RIGHT PARTITION BOUND
7 REM - S IS THE POINTER TO THE NEXT POSITION IN THE STACKS
10 DIM D(1000),SL(20),SR(20)
15 REM - GENERATE 1001 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 1000
30 D(I)=RND(0)
40 NEXT I
1000 REM - THIS IS NONRECURSIVE QUICKSORT
1004 REM - INITIALIZE THE STACKS WITH FIRST AND LAST TO START
1005 S=1: SL(1)=0: SR(1)=1000
1006 L=SL(S): R=SR(S): S=S-1  'POP TOP REQUEST FROM STACK
1007 REM - L=LEFT BOUND OF PARTITION TO BE PARTITIONED
1008 REM - R=RIGHT BOUND OF PARTITION TO BE PARTITIONED
1010 REM - NOW WE WILL PARTITION
1011 REM - BUT FIRST CHECK IF WE SHOULD USE SIS
1015 IF R-L < 22 THEN 3000 'IF WE HAVE 22 OR LESS USE SIS
1020     I=L:J=R
1030         X=D((I+J)/2)  'SELECT MIDDLE VALUE
1040             IF D(I) < X THEN I=I+1: GOTO 1040
1050             IF X < D(J) THEN J=J-1: GOTO 1050
1051 REM - THE LAST TWO LINES SELECTED AN ELEMENT IN THE
1052 REM - UPPER HALF THAT BELONGS IN THE LOWER AND IN THE
1053 REM - LOWER HALF THAT BELONGS IN THE UPPER
1056             IF I <= J THEN 1060 ELSE 1100
1060                 W=D(I):D(I)=D(J):D(J)=W 'EXCHANGE
1070                 I=I+1:J=J-1
1100         IF I>J THEN 1110 ELSE 1040
1110         IF I < R THEN S=S+1: SL(S)=I: SR(S)=R
1111 REM - THE LAST LINE PUSHED A PARTITION REQUEST ON THE
1112 REM - STACK. NOW WE WORK ON THE OTHER ONE.
1120         R=J
1130     IF L >= R THEN 1140 ELSE 1020
1139 REM - NOW WE SEE IF ANY REQUESTS ARE ON THE STACK
1140 IF S = 0 THEN 2000 ELSE 1006
2000 END    ' QUICKSORT/SIS IS FINISHED
3000 FOR J = L+1 TO R
3010 K=D(J)
3020 FOR L1 = J-1 TO L STEP -1
3030 IF K > D(L1) THEN D(L1+1)=K: GOTO 3200
3050 D(L1+1)=D(L1)
3060 NEXT L1
3080 D(L1)=K
3200 NEXT J
3210 GOTO 1140
9999 END
```

Listing 6. Quicksort and straight insertion sort.

Listing 4 is the nonrecursive Quicksort algorithm implemented in BASIC. Lines 1000–2000 form the actual sorting algorithm. Lines 1010–1070 perform the partitioning of the data into two groups—one greater than X and one less than X. X was chosen as the middle value in the data, although almost any value will work (some texts use the median value). The partitioning takes place by starting at both ends of the data and exchanging elements that are on the wrong side of X. At the end of this operation, I and J point to the two partitions. One of these is placed on the stack while the other is processed.

Quicksort will sort 100 random numbers in 32 seconds (as opposed to 210 for the bubble sort and 87 for the straight insertion sort). Quicksort will sort 600 numbers in 206 seconds. Straight insertion sort took 2809 seconds (I did not run bubble sort on this number of items but it would have taken over 10,000 seconds). It sorted 1000 numbers in 375 seconds, while straight insertion sort would take over 7000 seconds. In fact, the straight insertion sort time will increase as the square of the number of elements, while quicksort will increase as nLOG(n).

If you can implement Quicksort in a language like Pascal,which allows recursive calls to subroutines (or procedures), then the algorithm is greatly simplified. Listing 5 is the same algorithm written in Pascal using the recursive feature. You don't need to keep track of the partitions to be worked on since the sort procedure calls itself recursively until all partitions are done.

Quicksort may sound like the answer to a programmer's prayer; it's quick and not too complicated. But it does have a few problems. If the data to be sorted is already in sort, it is slower than the bubble sort (with flag) and the straight insertion sort. Also, if each time the algorithm selects a value for X it selects the largest value in the partition, Quicksort becomes very slow. Fortunately both of these conditions are not very likely.

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Another problem with Quicksort is that it does not perform very well with a small number of items. This can be improved by checking the size of each partition and converting to a straight insertion sort if the number of items is less than about 22. Listing 6 is the same Quicksort program in Listing 4, modified to use the straight insertion sort for small partitions. This change makes the algorithm about 8 percent faster with 500 elements to be sorted and almost 14 percent faster with 500 elements.

Conclusion

Several other fast algorithms for sorting exist, but none of them is faster than Quicksort. Use the straight insertion sort technique when you want to sort a small amount of data or when you want a simple program, and use the Quicksort (or Quicksort/straight insertion combination) when you need a very fast sort for large amounts of data. These two techniques will give you all the sorting tools you need.

If you would like to know more about these or other sorting algorithms, see *Algorithms + Data Structures = Programs* by Nicklaus Wirth. ■

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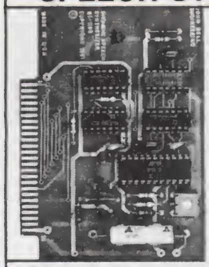

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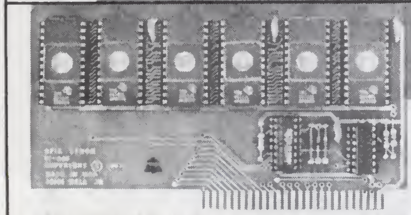

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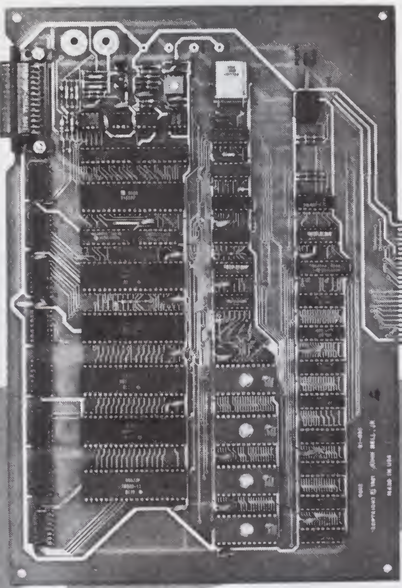

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Here are the necessary changes to run Quest Electronics' editor/assembler on the Elf II.

1802 Editor/Assembler

By Barry Erick

The Quest Electronics Editor/Assembler is for any 1802, so they issue the I/O and break routines to the user. But while they supply sample I/O routines, these have to be modified for use with the Elf-II and VID board. The following changes will get the Editor/Assembler up and running.

Serial I/O

First enter the serial I/O as listed in Quest's Editor/Assembler manual, page 8-8, in memory locations 0A00 to 0AF7 (hexadecimal). Then change all data in the serial I/O as listed in Table 1. Also enter the Register Save and Reset routine as listed in the same table. This is necessary to save R F.0, which is used in the Serial I/O routines, but not saved and reset in the built-in register routines in the Serial I/O routine.

```
026E   09  52
08B0   09  73
0950   80  55
0952   8F  73  9F  D4  0A  09
0958   12  F0  AF  9F  D5
0973   8F  73  9F  D4  0A
0978   06  12  F0  AF  9F  D5
0A01   0A
0A04   0A
0A15   09
0A18   50
0A28   3F
0A36   37
0A58   30
0A94   0A
0AA3   3F
0AA8   37
0AAD   3F
0AB2   37
0AB7   3F
0AC2   09
0AC5   50
```

Table 1. Changes and additions to the Editor/Assembler and Serial I/O necessary to run it on an Elf II.

This gives you the necessary serial I/O needed to operate the Editor/Assembler. The data rate must be added though, along with the Break routine. I also added a routine to check for form feed (CLS) and provide the delay necessary when the VID board is used. This is necessary because the VID board can take 1.5 seconds to erase the entire screen; and if the delay isn't provided, some characters would be lost, since the computer is outputting characters while the VID board is still erasing.

```
0000     F8 06 A3 F8 00 B3 D3 C0
0008     0A 00
0ACC     00
Original:
0000     F8 0D C8 F8 00 A6 F8 0D
0008     A3 F8
0ACC     D5
```

Table 2. Data Rate Find program and the original bytes which must be reinserted after finding the data rate.

The Data Rate

First, so that the data rate is correct from a warm start, I keep the data rate constants in memory at program location 0950 and 0951 (hexadecimal). This is reflected in the serial I/O by the changes at 0A15, 0A18, 0AC2 and 0AC5. To find the constant for any other rate, enter and run the program in Table 2. When entered, hit the return key. This will compute and automatically place the correct data rate constants in the program memory, and the program will halt. Be sure to

```
093D     09 90
0946     60
0960     FB 0C 32 66 30 3F F8 40
0968     BF 2F 9F 3A 69 F8 0C BF
0970     30 3F
0990     D4 09 3F 45 4C 46 20 49
0998     49 20 6D 6F 64 73 20 62
09A0     79 20 42 41 52 52 59 20
09A8     45 52 49 43 4B 0D 00 C0
09B0     00 B0
```

Table 3. The CLS delay routine, plus a headline.

Address correspondence to Barry Erick, 28 Ridge St., Dallas, PA 18612.

change 0ACC to 00 before you run the Data Rate Find program to kill the program, and to change 0ACC back to its original value (D5) after. Also be sure to reenter the first ten locations of the Editor/Assembler program to their original value. (The "find the data rate" portion of the serial I/O is used only this one time.)

CLS Delay

To provide a delay on the CLS (form feed) routine, I changed the character output routine to check for a 0C (ASCII form feed) after it has been output to the Serial Out routine and returned to the main program. If found, a delay routine is entered to waste some time while the VID board catches up. The output character is passed to, and returned from, the Serial Out routine in both the D register and RF. 1. The changes needed to add this feature are listed in Table 3.

The Break Routine

Quest also provided space in the Editor/Assembler for a Break routine, which you must write. (They do provide a sample listing, but it won't help the Elf II user.) Using only the hex input key usually provides a break that aborts any listing. Sometimes, though, especially if you don't have hard copy, you would like to just momentarily stop the listing in progress, and then resume. The routine I wrote gives you just such an option. Pressing the input key during a listing gives us a break, and the Break routine then waits for an input from the ASCII keyboard. If a space is encountered, the listing continues. But if a Return is entered, the listing aborts. (Any other entry is nearly ignored.) The Break routine, and changes needed in the Editor/Assembler, are listed in Table 4.

Monitor Jump

As stated, a monitor jump has to be provided. Table 5 shows the changes to be made to the program, to be able to jump into the Netronics Monitor at F000.

Moving into EPROM

I have my copy of Quest's Editor/Assembler resident in EPROM. Since the Editor/Assembler is not written in relocatable code, all address reference data had to be searched for and changed to the new page. It turns out that after starting and searching, I found 180 changes to make to move the Editor/Assembler into EPROM. Those changes are shown in Table 6.

Memory Allocation

In either the RAM version or in the EPROM version of the Editor/Assembler, attention must be given to memory allocation. Table 7 gives my recommended locations. Refer to Quest's manual, page 5-2, for the addresses of the program that you need to change. Note that for the EPROM version, the addresses to be changed are found by adding the EPROM starting address to the printed address. Also, in the EPROM version, the label table I recommend is two pages long while Quest recommends one page. I did this when I quickly ran out of label space. Two pages let you produce about 64 labels.

Conclusion

After you make the changes necessary to get Quest's Editor/Assembler up and running on your Elf II (whether or not you put it in EPROM), assemble some programs using the Editor/Assembler. I think that you'll agree that it's much easier to do this than to use machine code to write a program (unless the program is very short).■

The Editor/Assembler is available for $25 from Quest Electronics, PO Box 4438, Santa Clara, CA 95854.

```
089D    0A 03
08A0    09 7E
097E    D4 09
0980    52 FB 20 C2 08 A2 FB 2D
0988    C2 00 03 30 7E
0AF3    3F FA F8 00 FF
0AF8    00 D5 F8 00 FC 00 D5 00
```

Table 4. The Break routine.

```
0478    08 A5
08A5    F8 00 A0 F8 F0 B0 E0 D0 00
```

Table 5. The Monitor jump listing.

Table 6. The changes necessary to place the Editor/Assembler in EPROM. "X" is the first page of the EPROM address. Ex: Editor is to be in EPROM at C000 to CAFF. In this example X = C0; X + 8 = C8; etc.

```
000A=X        000E=X+8      001E=X+3      0028=X+2
002D=X+2      0030=X+2      0046=X+4      0054=X+3
0062=X+2      0067=X+7      006A=X+4      006D=X+2
0070=X+1      0075=X+8      0078=X+1      007D=X+1
0080=X+2      0084=X+1      008A=X+2      0094=X+4
0099=X+2      009C=X+2      00A6=X+1      00A9=X+1
00AE=X+8      00B9=X+2      00BC=X+2      00C1=X+2
00C4=X+2      00CC=X+2      00D9=X+4      00DE=X+2
00E9=X+1      00EF=X+1      00FB=X+2      0101=X+1
0104=X        0138=X+2      013E=X+2      015C=X+8
0165=X+2      016D=X+2      0187=X+2      0190=X+1
0197=X+2      019A=X+1      01A0=X+2      01CD=X+1
01D0=X+2      01F8=X+2      01FF=X+1      0202=X+1
020D=X+4      0210=X+2      023B=X+2      024E=X+2
```

More →

Table 6 continued.

```
0257=X+7     025E=X+4     0263=X+2     026B=X+8
026E=X+9     0279=X+2     028E=X+2     02A7=X+8
02DC=X+3     02DF=X+4     02E2=X+3     02E5=X
02F6=X+3     0302=X+2     031A=X+2     031A=X+2
031D=X+1     032A=X+1     0339=X+3     0347=X+7
034C=X+3     0373=X+3     039A=X+1     039F=X+6
03A4=X+5     03A7=X+2     03AB=X+8     03AF=X+5
03B5=X+2     03D3=X+5     03EF=X+3     03F2=X+3
03F5=X+4     03FE=X+4     041A=X+5     041E=X+3
0421=X+3     0424=X+3     0427=X+3     0440=X+5
0462=X+2     0466=X+3     046C=X+3     0474=X
0478=X+8     047B=X       047E=X+1     048B=X+2
048E=X+2     0497=X+3     049C=X+3     049F=X+3
04BE=X+2     04CC=X+2     04D4=X+3     04DD=X+3
04E7=X+3     04F9=X+8     0505=X+3     0511=X+1
0515=X+3     0518=X+4     052D=X+3     0549=X+3
055A=X+4     0560=X+5     0564=X+3     0579=X+4
057E=X+1     0582=X+3     0585=X+4     0588=X+4
05A4=X+7     05A7=X+4     05B3=X+5     05B9=X+1
05BE=X+4     05C3=X+5     05DA=X+2     05DD=X+1
05E8=X+5     05EB=X+3     05F8=X+5     05FC=X+5
07E1=X+2     07F2=X+5     07FE=X+2     0835=X+2
0841=X       0848=X+2     0873=X+3     087A=X+2
087D=X+2     0880=X+2     0883=X+2     0886=X
0889=X+2     088C=X+2     088F=X+2     0892=X+2
0895=X+2     089A=X+5     089D=X+A     08A0=X+9
08A3=X+3     08B0=X+9     08BF=X+4     08C2=X+2
08CD=X+2     08E6=X+3     08E9=X+4     08EF=X+9
097F=X+9     0984=X+8     0989=X       098C=X+9
0991=X+9     09B0=X       0A15=X+9     0AC2=X+9
```

```
    (a)                              (b)

xy3D=Stack                       xy3D=Stack

xy00=Text Buffer                 xy00=Text Buffer

0C00=Source/Object Code          0200=Source/Object Code

0B00=Label Table                 0000=Label Table

0000=Editor/Assembler
```

Table 7. The typical memory allocations, where "xy" is the last RAM page in memory. Table 7a shows the RAM version, while 7b shows the EPROM version.

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Here's an artful application of the TVBUG that turns your micro into a color slate to draw pictures.

Parti-Colored Picture Pad

By M. L. Shore and L. K. R. Williams

We had finished building the Motorola TVBUG, and the world of electric color was at our fingertips. Exploiting the system's color graphics abilities was just a question of providing a substantial amount of software support.

The program described here uses the computer as a color slate for drawing pictures. Drawing is done by picking a color via the keyboard, and holding down one of the four cursor-control keys. A pseudo-color (cursor skip) lets you move the cursor around without disturbing the picture. A cursor home key lets you place the cursor at the top left-hand pixel (picture element) of the screen.

A number of special function keys (see Table 1) let you break out of the graphics mode, save pictures and restore them. It is heartbreaking to spend hours composing a modern-day Mona Lisa, only to switch the machine off. The storage-and-retrieval feature is useful for demonstrating the graphics capabilities of the TVBUG system.

TVBUG

The TVBUG system allows for 12 different video-display graphics (VDG) modes—two alphanumeric, two semigraphics and eight graphics (see Table 2). The normal working mode of the system is, predictably, alphanumeric internal. The graphics mode we have chosen for this application is graphics 2C. In this mode the screen is divided into a 128 by 64 pixel array, held in memory as 2K bytes. Each byte represents four pixels in a horizontal row. The graphics 2C mode can be used with one of two color sets (but not both): green, red yellow and blue or buff, orange, cyan and magenta. You choose the color set when the system is put into graphics mode via a memory-mapped pin on the VDG chip.

Cursor Keypad

Although it's not included as part of the TVBUG kit, you can attach a cursor-control keypad to the system. The five cursor-control pins on the keyboard connector are attached to 10k resistors, which go to ground. They also connect to one side of a normally open switch (the cursor-control key). The other side of this switch is con-

Command	Function
Esc	revert to monitor
Q	revert to start of program
S	store current picture
L	put stored picture back onto screen
C	select cursor-skip
G	select green/buff
R	select red/orange
Y	select yellow/cyan
B	select blue/magenta

Table 1. Keyboard commands.

Mode	Description	Color set
alphanumeric internal	32 × 16	—
alphanumeric external	32 × 16	—
semigraphics 4	64 × 32	all eight
semigraphics 6	64 × 48	green yellow blue red
graphics 1C	64 × 64	green yellow blue red
graphics 1R	128 × 64	green black
graphics 2C	128 × 64	green yellow blue red
graphics 2R	128 × 96	green black
graphics 3C	128 × 96	green yellow blue red
graphics 3R	128 × 192	green black
graphics 6C	128 × 192	green yellow blue red
graphics 6R	256 × 192	green black

Table 2. VDG modes.

Address correspondence to M. L. Shore and L. K. R. Williams, Defence EDP, PO Box 50247, Porirua, New Zealand.

nected to a +5 V supply (see Fig. 1).

The Program

The layout of the program is described in Fig. 2. As you can see, subroutines are not called directly but via a subroutine-jump table. This lets you relocate subroutines safely, and was invaluable in program testing.

The initialization phase of the program is 0100 through 0150 (hexadecimal). This phase puts a heading on the screen, and asks for the color set. The reply is decoded and stored as the VDG mode byte. Then the background color is requested, the answer decoded and a four-pixel color byte stored. The program is then put into graphics mode by altering locations F441 through F443, the screen is filled with the background color and the cursor is homed.

0151 through 018F represents the main program-control loop, shown in flowchart form in Fig. 3. The keyboard input byte is mapped to F404, and the cursor keypad input to F406. Little needs to be explained about this control loop—it is quite straightforward. Note the use of a complemented pixel as the cursor.

The decode-color subroutine, 0193 through 01B3, uses the hexadecimal representation of the four color codes —GRYB (green, red, yellow, blue)—to generate the correct VDG two-bit code for the pixel. Note that the subroutine generates a byte full of these pixels.

The move-cursor routine, 01B8 through 01E4, is outlined in the flowchart in Fig. 4. When designing the system, we decided to hold the cursor position as an (x,y) coordinate pair, rather than as an address and pixel position. This makes cursor movement easy but requires address and mask generation for each screen access. In practice the (x,y) coordinate-pair method was simple and effective. Note the use of (x,y) coordinate masks in the subroutine which provide horizontal and vertical wraparound.

01EB through 0222 contains the get-screen-address-and-mask subroutine. This is represented as a flowchart in Fig. 5, and is relatively simple.

0229 through 0240 is the string-out subroutine used to place the program heading and question strings on the screen at a specified position (bytes 0010,0011). The subroutine merely copies bytes from one memory location to another.

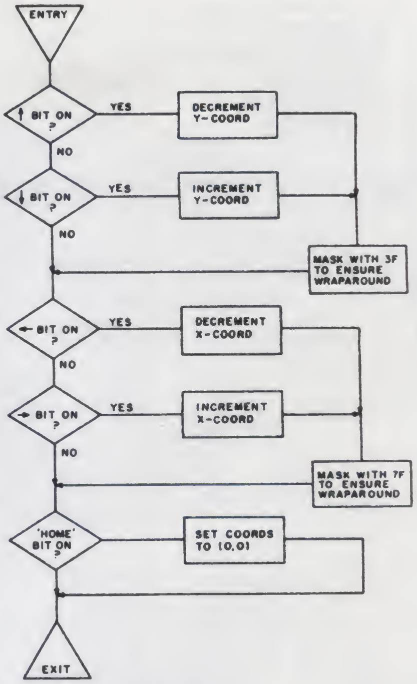

Fig. 4. Move cursor.

The store-pixel routine, 0247 through 026A, puts a pixel onto the screen. As can be seen from Fig. 6, this involves getting the screen byte,

(text continued on page 174.)

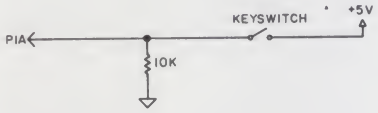

Fig. 1. Cursor-control key circuitry.

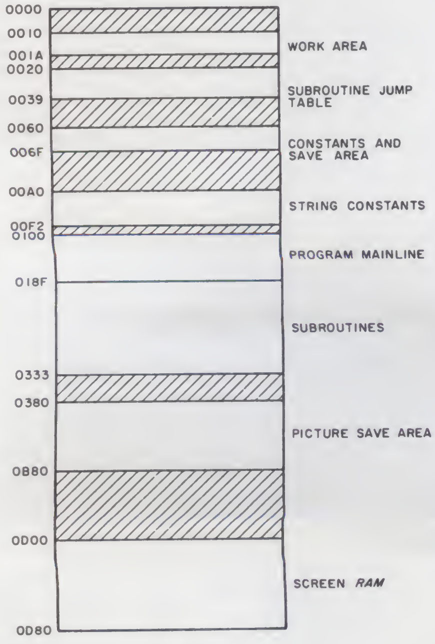

Fig. 2. Program layout.

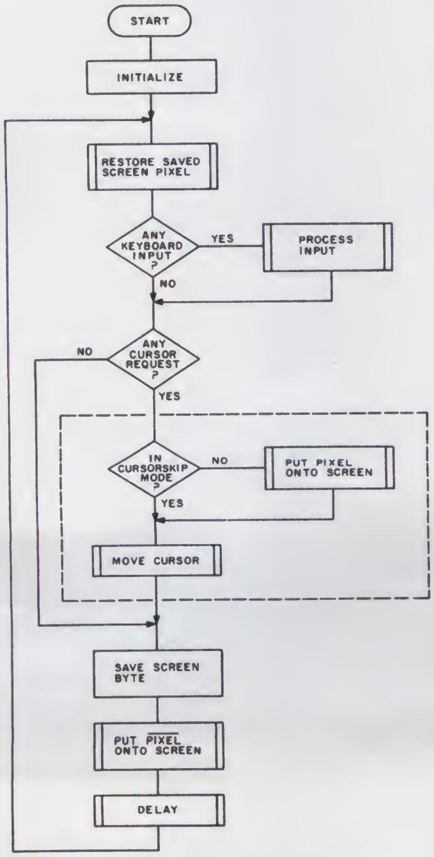

Fig. 3. Overall flowchart.

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Program listing in 6800 machine code.

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0020  0271                                   (clear screen
0022  0229                                   (string out
0024  FEE1                                   (char in - echo back
0026  0285                                   (delay
0028  FFA8                                   (monitor initialize
002A  0193                                   (decode color
002C  01EB                                   (get address & mask
002E  02B4                                   (process input
0030  0298                                   (get byte from screen
0032  0247                                   (store pixel on screen
0034  01B8                                   (move cursor
0036  02F8                                   (store picture
0038  0317                                   (load picture
0060  00                                     (b/g color
0061  00                                     (x-coord
0062  00                                     (y-coord
0063  00                                     ( -
0064  3FCFF3FC                               (pixel masks
0068  11                                     (VDG mode
0069  0000                                   (  -
006B  00                                     (current color request
006C  00                                     (cursor-skip indicator
006D  0380                                   (start of picture save area
00A0  4348524F4D4120504943545552450 0        (CHROMA PICTURE
00B8  475245454E204F52204255464620534554 00(GREEN OR BUFF SET
00D0  4241434B47524f554E4420434F4C4F5200     (BACKGROUND COLOR
0100  DE28    LDX      $28               (system initialize
      AD00    JSR      X
      CED069  LDX      =$D069            (put heading onto screen
      DF10    STX      $10
      86A0    LDA A    =$A0
      DE22    LDX      $22
      AD00    JSR      X
010F  CED0A0  LDX      =$D0A0            (ask for color set
      DF10    STX      $10
      86B8    LDA A    =$B8
      DE22    LDX      $22
      AD00    JSR      X
      DE24    LDX      $24               (get and decode answer
      AD00    JSR      X
      8401    AND A    =$01
0120  8A10    OR  A    =$10
      9768    STA A    $68
      CED0E0  LDX      =$D0E0            (ask for background color
      DF10    STX      $10
      86D0    LDA A    =$D0
      DE22    LDX      $22
      AD00    JSR      X
012F  DE24    LDX      $24               (get and decode answer
      AD00    JSR      X
      DE2A    LDX      $2A
      AD00    JSR      X
      9760    STA A    $60
      4F      CLR A                      (put program into graphics mode
      B7F441  STA A    $F441
      43      COM A
013E  B7F442  STA A    $F442
      9668    LDA A    $68
      B7F443  STA A    $F443
      DE20    LDX      $20               (clear graphics screen
      AD00    JSR      X
      9763    STA A    $63               (save screen byte
      4F      CLR A                      (home cursor
      9761    STA A    $61
014F  9762    STA A    $62
```

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```
0151   9663    LDA A   $63        (restore byte onto screen
       DE32    LDX     $32
       AD00    JSR     X
       01      NOP
       01      NOP
       01      NOP
       01      NOP
       01      NOP
       01      NOP
       B6F404  LDA A   $F404      (get keyboard input
0160   2B04    BMI     *+4
       DE2E    LDX     $2E        (process input
       AD00    JSR     X
       B6F406  LDA A   $F406      (cursor request?
       841F    AND A   =$1F
       2714    BEQ     *+20
       36      PSH A              (save cursor request on stack
       966C    LDA A   $6C
0170   2606    BNE     *+6
       966B    LDA A   $6B
       DE32    LDX     $32        (store pixel on screen
       AD00    JSR     X
       32      PUL A              (get back cursor request
       DE34    LDX     $34
       AD00    JSR     X
       DE30    LDX     $30        (save screen byte
017F   AD00    JSR     X
       9663    LDA A   $63        (store p̅i̅x̅e̅l̅ on screen
       43      COM A
       DE32    LDX     $32
       AD00    JSR     X
       8680    LDA A   =$80       (delay
       DE26    LDX     $26
       AD00    JSR     X
018E   20C1    BRA     0151       (loop back
0193   9716    STA A   $16        (store color byte
       8410    AND A   =$10       (isolate bit 4
       47      ASR A              (move down to bit posn 0
       47      ASR A
       47      ASR A
       47      ASR A
       9717    STA A   $17        (store temporarily in 17
       9616    LDA A   $16        (get compliment of bit 0
       43      COM A
01A0   8401    AND A   =$01
       48      ASL A              (move up to bit posn 1
       9A17    OR  A   $17        (combine with earlier bit
       9717    STA A   $17        (store pixel code in 17
       48      ASL A
       48      ASL A
       9A17    OR  A   $17        (make two pixels
       9717    STA A   $17
       48      ASL A
       48      ASL A
       48      ASL A
01B0   48      ASL A
       9A17    OR  A   $17        (make four pixels
01B3   39      RTS
01B8   D662    LDA B   $62        (y-coord
       46      ROR A
       2403    BCC     *+3
       5A      DEC B              (↑
       2004    BRA     *+4
01C0   46      ROR A
       2407    BCC     *+7
       5C      INC B              (↓
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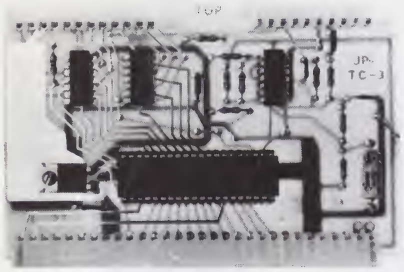

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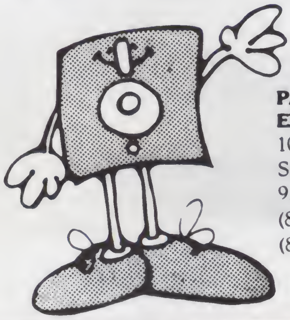

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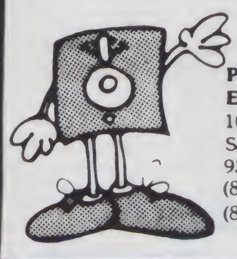

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Program continued

```
       C43F    AND B   =$3F      (wrap around if off screen
       D762    STA B   $62
       201A    BRA     *+26
       D661    LDA B   $61       (x-coord
       46      ROR A
       2403    BCC     *+3
       5A      DEC B             (←
01D0   2004    BRA     *+4
       46      ROR A
       2407    BCC     *+7
       5C      INC B             (→
       C47F    AND B   =$7F      (wrap around if off screen
       D761    STA B   $61
       2008    BRA     *+8
       46      ROR A
       2405    BCC     *+5
       5F      CLR B             ( home
01E0   D761    STA B   $61
       D762    STA B   $62
01E4   39      RTS

01EB   CED000  LDX     =$D000    (screen start
       DF10    STX     $10
01F0   D662    LDA B   $62       (y-coord
       270F    BEQ     *+15
       9611    LDA A   $11       (add 32 to 10,11
       8B20    ADD A   =$20
       9711    STA A   $11
       9610    LDA A   $10
       8900    ADC A   =$00      (note any carry
       9710    STA A   $10
0200   5A      DEC B             (do this y-coord times
       26F1    BNE     *-15
       9661    LDA A   $61       (x-coord
       47      ASR A             (divide by 4
       47      ASR A
       9B11    ADD A   $11       (add to 10,11
       9711    STA A   $11
       9610    LDA A   $10
       8900    ADC A   =$00      (not any carry
020F   9710    STA A   $10
       9661    LDA A   $61       (mask address is found by
       8403    AND A   =$03      (checking x-coord bits 0,1
       8B64    ADD A   =$64      (mask table starts at 64
       9713    STA A   $13       (store mask address in 13
       4F      CLR A
       9712    STA A   $12       (actual mask into 13
       DE12    LDX     $12
       A600    LDA A   X
0220   9713    STA A   $13
0222   39      RTS

0229   9717    STA A   $17       (string start into 16,17
       4F      CLR A
       9716    STA A   $16
       DE16    LDX     $16
0230   A600    LDA A   X         (get next string ch
       270C    BEQ     *+12
       08      INX
       DF16    STX     $16       (restore updated string ptr
       DE10    LDX     $10       (get screen byte address
       A700    STA     X         (store ch on screen
       08      INX
       DF10    STX     $10       (update screen ptr
       20EE    BRA     *-17
0240   39      RTS
0247   9719    STA A   $19       (save pixel byte
```

More →

Program continued

```
        DE30    LDX     $30
        AD00    JSR     X             (get screen byte,address and mask
        9663    LDA A   $63
        01      NOP
0250    01      NOP
        9413    AND A   $13           (remove pixel
        9714    STA A   $14
        9613    LDA A   $13
        43      COM A
        9419    AND A   $19           (isolate pixel to be stored
        9A14    OR  A   $14           (put into byte
        0F      SEI                   (stop peripheral ints
        F6F406  LDA B   $F406         (wait until horiz sync
0260    2AFB    BPL     *-4
        F6F406  LDA B   $F406
        2BFB    BMI     *-4
        A700    STA A   X             (store byte on screen
        0E      CLI                   (allow interrupts
026A    39      RTS
0271    9660    LDA A   $60            (background four pixels
        CED000  LDX     =$D0000        (screen start
        A700    STA A   X
        08      INX
        8CD800  CPX     =$D800         (end of screen?
        26F8    BNE     *-12
027E    39      RTS
0285    4A      DEC A                  (millisecond count
        270B    BEQ     *+11
        8D02    BSR     *+2
        20F9    BRA     *-6
        37      PSH B                  (main 1 milli loop
        C68F    LDA A   =$8F
        5A      DEC B
0290    26FD    BNE     *-3
        33      PUL B
0293    39      RTS

0298    DE2C    LDX     $2C           (get screen address & mask
        AD00    JSR     X
        DE10    LDX     $10
        0F      SEI                   (interrupts off
029F    B6F406  LDA A   $F406
        2AFB    BPL     *-5
        B6F406  LDA A   $F406
        2BFB    BMI     *-5
        A600    LDA A   X             (load screen byte
        9763    STA A   $63
        0E      CLI                   (allow interrupts
02AE    39      RTS

02B4    8143    CMP A   =$43           ("C"  cursor-skip
        2604    BNE     *+4
        976C    STA A   $6C
        2035    BRA     *+53
        8151    CMP A   =$51           ("Q"  quit this picture
        2608    BNE     *+8
02C0    86BF    LDA A   =$BF
        B7F441  STA A   $F441
        7E0100  JMP     $0100
        811B    CMP A   =$1B           ("Esc"  back to monitor
        2608    BNE     *+8
        86BF    LDA A   =$BF
02CE    B7F441  STA A   $F441
        7EFAD7  JMP     $FAD7
        8153    CMP A   =$53           ("S"  save picture
        2606    BNE     *+6
        DE36    LDX     $36
        AD00    JSR     X
```

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Program continued

```
        2013    BRA     *+19
        814C    CMP A   =$4C          ("L"  load picture
02E0    2606    BNE     *+6
        DE38    LDX     $38
        AD00    JSR     X
        2009    BRA     *+9
        5F      CLR B                 (must be color request
        D76C    STA B   $6C           (clear cursor-skip
        DE2A    LDX     $2A
        AD00    JSR     X
02EF    976B    STA A   $6B           (store current color
02F1    39      RTS
02F8    CED000  LDX     =$D000        (screen start
        DF10    STX     $10
        DE6D    LDX     $6D           (save area start
02FF    DF12    STX     $12
        DE10    LDX     $10           (get next screen byte
        8CD800  CPX     =$D800        (end of screen?
        270E    BEQ     *+14
        A600    LDA A   X
        08      INX
        DF10    STX     $10
        DE12    LDX     $12
030F    A700    STA A   X
        08      INX
        DF12    STX     $12
        20EB    BRA     *-20
0316    39      RTS
0317    CED000  LDX     =$D000        (screen start
        DF10    STX     $10
        DE6D    LDX     $6D           (save area start
        DF12    STX     $12
0320    DE12    LDX     $12           (get saved byte
        A600    LDA A   X
        08      INX
        DF12    STX     $12
        DE10    LDX     $10
        A700    STA A   X             (put byte onto screen
        08      INX
        DF10    STX     $10
032E    8CD800  CPX     =$D800        (end of screen?
        2DED    BLT     *-18
0333    39      RTS
```

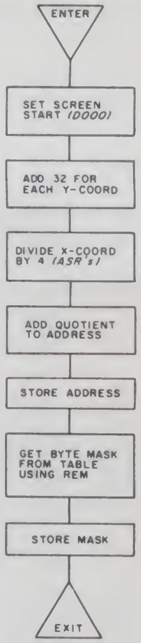

Fig. 5. Converting (x,y) to address and mask.

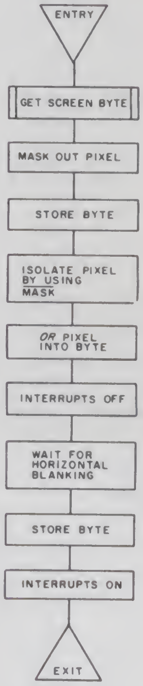

Fig. 6. Store pixel on screen.

placing the pixel into the byte and then storing the byte. Both accesses to memory have to wait for the screen horizontal-blanking period. Unless this is done, flecking occurs on the screen. Note that the call to the load-pixel subroutine has the effect of also loading addresses 0010,0011 with the screen byte address, and location 0013 with the pixel mask.

The clear the screen, 0271 through 027E, performs the task of placing the background color byte into all 2K screen-memory-mapped locations. You need not worry about waiting for the horizontal-blanking period in this subroutine.

0285 through 0293 contains the delay subroutine, which causes a 1 ms delay for the number of times specified in accumulator A.

0298 through 02AE is a simple subroutine that gets the screen-address byte, waits for the horizontal-blanking period and then loads the byte.

The input-decode subroutine is at 02B4 through 02F1, and is described by the flowchart in Fig. 7. Note that only the special commands and the pseudo-color command are specifically tested for; any other input is assumed to be a color request and decoded accordingly. This subroutine is really a subcontrol routine, delegating input processing work to other subroutines.

The save-picture subroutine, 02F8 through 0316, is merely one loop that copies 2K from screen memory to another 2K block of memory.

0317 through 0333 performs the reverse operation of that in the save-picture subroutine. Note that there is no need to wait for horizontal synchronization in these two subroutines.

Program Operation

This program is not meant to be a

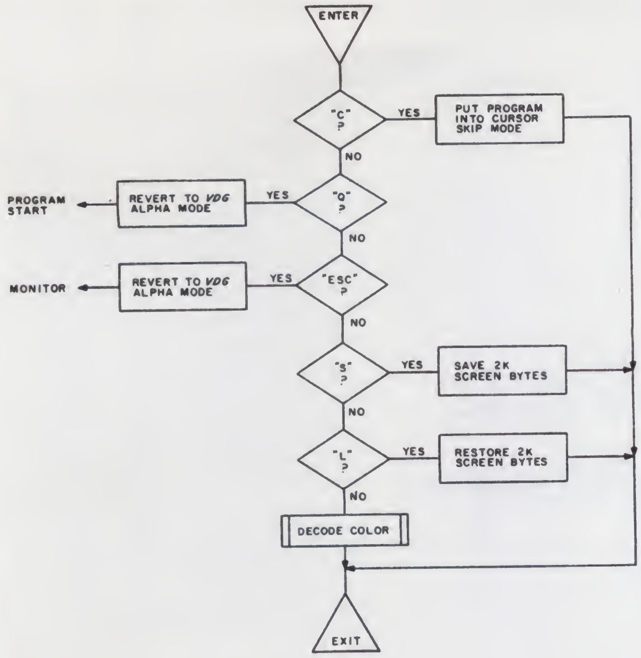

Fig. 7. Process input.

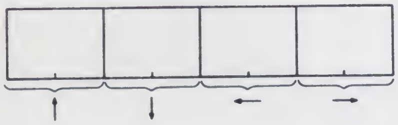

Fig. 8. Joystick byte coding.

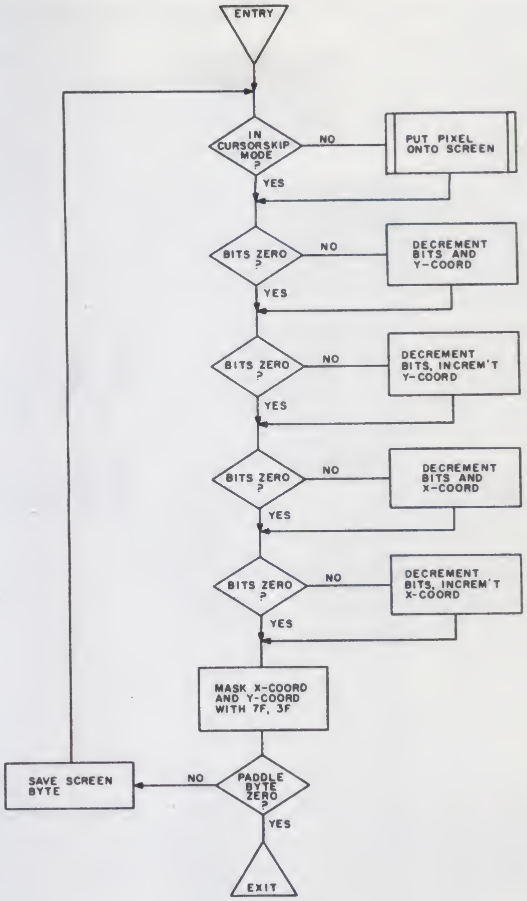

Fig. 9. Modified move cursor for paddle.

model of 6800 coding. In fact, it was our first program in 6800 machine code. It does, however, represent an interesting and colorful application for the TVBUG.

Once we got the basic program working, we found that it responded to the cursor-control keys with somewhat more enthusiasm than was really required. Thus we put in a delay subroutine and found that a delay of about 128 ms was about right. In the first instance we tried to use a flashing cursor by introducing two delays, one after restoring the pixel to the screen, the other after putting the pixel on the screen. However, we found the flashing cursor rather disconcerting and hence replaced the initial delay coding with no ops. If you wish to experiment with a flashing cursor, then apply the patches in Table 3.

We were disappointed with the color clarity of vertical lines, even at this reasonably low resolution. But it appears that this problem is due to the limited bandwidth of the color TV used, rather than TVBUG. A single vertical line is mostly a muddy indistinct color, but horizontal lines are quite clear and very acceptable. The best approximation to the four colors that we could get with a vertical line was with a yellow background in the green color set. To get true colors in vertical lines, we needed to draw three lines together.

Although the program as it stands performs adequately, it is difficult to draw inclined or curved lines. This could be solved by implementing a joystick onto the system. Then, rather than use the cursor-control keypad to draw lines, pictures could be drawn by moving the joystick. The 360-degree movement would allow inclines and curves under easy user control.

Address	Byte
0157	86
0158	50
0159	DE
015A	26
015B	AD
015C	00
0189	50

Table 3.

The joystick input byte could possibly be coded as in Fig. 8, giving an increment value in the range 0 through 3 for each of the four directions currently used on the cursor-control keypad. Then the dotted box in Fig. 3 could be replaced by a call to a modified cursor-control movement routine, as in Fig. 9. Thus with a certain amount of hardware modification, the program would be somewhat easier to use.

In the same vein, the use of the GRYB keys on the keyboard is fine when in the green color set, but somewhat meaningless in the buff set. What would be better would be a separate pad with a four-key set with bisected tops, colored green and buff, red and orange, etc. One could imagine the final artist's electric "palette" being completely separated from the keyboard, and connected to the computer via a lead. The palette would contain color keys, control keys and a joystick, or perhaps our electric artist would even be equipped with a paintbrush in which a light pen was concealed. Eat your heart out, Van Gogh! ■

Here's a shortcut that can save you traveling time with the "Cadillac of word processors."

WordStar RoadMap

By Charles R. Perelman

WordStar is indeed the Cadillac of word processors, as Charles Platt says in the May 1981 issue ("Hot Rod Word Processors," p. 40). But the manual, though extensive and informative, has one serious lack: no index.

I've used WordStar for many applications, including a book exceeding 100 pages, and a quick reference guide is an absolute necessity. The index provided here saves me the frustration of calling various menus, and often still not finding the information I want. I've included the Mailmerge option.

I've also discovered a few tricks not covered in the manual which will help you get more out of the software. The controls mentioned here are for the TRS-80 Model II, so there may be some variation with other computers.

First, if you want to underline spaces as well as characters, don't use the embedded underline control in the same line, but instead overprint the spaces on the following line.

Second, on 96-character printwheels, you can get additional characters by pressing the control key and the digit 6, 9 or 0 at the same time. The manual does cover the ability to obtain two additional characters with the Phantom Space (control-F) and Phantom Rubout (control-G).

Third, the F1 key sends out a control A and the F2 key a control B. You may find it quicker to move the cursor back one word with the F1 key and to reform paragraphs with the F2 key, rather than use two separate key strokes.

Fourth, to reformat an entire document—as, for example, when you want to change the margins throughout—use the repeat function: control QQ, followed by control-B or F1 and number 1 for the fastest speed. You must be sure that Hyphen-help is off.

The index and these hints should significantly speed up your use of this fine word processing software, and reduce the training time for new users.■

Address correspondence to Charles R. Perelman, A Professional Corporation, 9777 Wilshire Blvd., Suite 700, Beverly Hills, CA 90212.

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This school district traded in its no. 2 lead pencils for PET computers to administer competency exams.

Put to the Test By a Computer

By Leonard T. Meuer

High school students in the Travis, CA, Unified School District must pass a series of competency exams to graduate. Formerly, we used a standard and familiar system: students were given booklets, and blacked the appropriate spaces on corresponding answer sheets. But while the scoring agency was able to handle the scoring of the major categories—reading, writing and math—it was unable to score the subcategories without extensive reprogramming and cost. So we decided to switch to an alternative system, using three Commodore PETs.

The new alternative system uses the same general instructions and questions as the paper-and-pencil exams. A student sits down at the microcomputer and the exam is started by a staff member. Instructions are presented on a cleared video display. The student types in his or her name *and number*, and the questions are presented one at a time.

The student presses a 1, 2, 3, 4 or 5 for his choice. Since wrong answers are not counted against the student, he is encouraged and must respond to go on to the next question. Upon pressing the number of his choice the next question is presented.

The computer will only respond when 1, 2, 3, 4 or 5 is pressed. After completing all questions a student is thanked by the computer and instructed to report to his normal assigned place, and told that he will later be contacted by his counselor with the results.

All three exams are on one disk, which is write-protected. The program runs on 16K machines. Student responses are automatically recorded on a second disk. Scoring is done by yet another program, for security reasons. One disk will hold the scores for a minimum of 500 students.

A student cannot call up a program without the proper passwords. Immediately upon completion of an exam, it is cleared from the computer. He cannot self-score or list the program, or scan it for the answers. Since all programs of the system are disk-based, security is tightened by placing the disk in a locked metal file along with the backup disks.

Conclusions

Students that tried the exams liked it. They felt more motivated even though the questions were the same as the written version. They felt that the process was much less tedious and time-consuming because of not having to blacken in the silly little squares on the answer sheets, and they didn't have to be concerned with putting their answer in the wrong block, making it black enough or having smudges on the answer sheet.

Since questions are presented only one at a time, a student's concentration doesn't wander to other questions. A student does his or her own work because he or she doesn't have someone else's answer sheet to look at. Visually or physically handicapped students were able to progress through the exams without special attention.

From the prepilot and pilot information gathered we feel that the administering of competency exams by computer is a valid alternative method of administering the exams, and that it provides a method of meeting special needs. The scoring programs used provide the necessary information without superfluous markings on the answer scoring sheets. Standard exams can also be scored in the same format by using an answer sheet reader attached to the microcomputer system. Thus, a one-time capital outlay (less than the cost of sent-out scoring) results in considerable dollar and time savings.■

Address correspondence to Leonard T. Meuer, 1790 Burbank Court, Fairfield, CA 94533.

```
AAFW            WRITING                 7-14-81
AAFW              1
OVER-ALL SCORE =  90.90908  %
TOTAL ELAPSED TIME = 637
 1     FIND INCOMPLETE SENT.   1*
 2     FIND INCOMPLETE SENT.   2*
 3     FIND INCOMPLETE SENT.   3*
 4     FIND INCOMPLETE SENT.   1*
 5     FIND COMPLETE SENT.     2*
 6     FIND COMPLETE SENT.     1*
 7     FIND COMPLETE SENT.     4*
 8     FIND COMPLETE SENT.     2* 100   % ON COMP#  01
 9     END PUNCTUATION         2*
 10    END PUNCTUATION         3*
 11    END PUNCTUATION         1*
 12    END PUNCTUATION         2*
 13    SPELLING-E SOUND        2*
 14    SPELLING-E SOUND        4*
 15    SPELLING-K SOUND        3*
 16    SPELLING-PLURAL         1*
 17    SPELLING-F SOUND        1*
 18    SPELLING-PLURAL         2*
 19    SPELLING-ADD LY         4*
 20    SPELLING-COMPOUNDS      3*
 21    SPELLING-ADD ING        1*
 22    SPELLING-ADD ING        2*
 23    SPELLING-ADD ITY        1*
 24    SPELLING-ADD ED/ING     2
 25    SUBJECT-VERB AGREEMENT 2*
 26    SUBJECT-VERB AGREEMENT 2*
 27    SUBJECT-VERB AGREEMENT 1*
 28    SUBJECT-VERB AGREEMENT 1*
 29    SUBJECT-VERB AGREEMENT 3*
 30    SUBJECT-VERB AGREEMENT 3*
 31    SUBJECT-VERB AGREEMENT 1
 32    SUBJECT-VERB AGREEMENT 4*
 33    WORD CAPITALIZATION     4*
 34    WORD CAPITALIZATION     3*
 35    WORD CAPITALIZATION     2*
 36    WORD CAPITALIZATION     1*
 37    PUNCTUATION-COMMAS      1*
 38    PUNCTUATION-COMMAS      4*
 39    PUNCTUATION-COMMAS      4*
 40    PUNCTUATION-COMMAS      1*
 41    APOSTROPHES-CONTRACT    3*
 42    APOSTROPHES-CONTRACT    2
 43    APOSTROPHES-CONTRACT    2*
 44    APOSTROPHES-POSSESS     4 88.8888889  % ON COMP#  02
```

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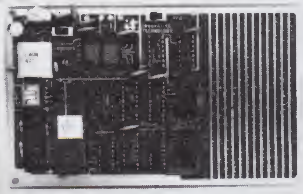

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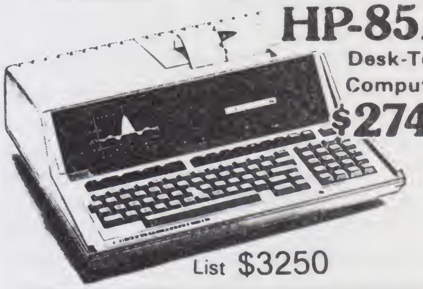

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When it comes to extending BASIC with assembly-language routines, the former has the advantage.

Compiled vs Interpreted BASIC

By Murray L. Lesser

One of the advantages of using a compiled BASIC is that you can easily extend the language to suit your own needs by using assembly-language subroutines. Such language extensions operate like built-in functions: you call them by name, along with the BASIC variables to be operated upon.

As an example of how this works, I'll give two such added functions, along with a pair of system utilities that use them. All examples are written for Microsoft's BASCOM (the compiler version of BASIC-80) running under CP/M, but you can modify them to suit your own system.

The first subroutine, PICKUP, makes a BASIC string variable out of the rest of the CP/M "command line" that was keyed in along with the program call. This lets you pass variable information to the program as part of the original keyed-in calling sequence.

The second function, SCRAM, is a substitute for BASIC's RUN or CHAIN commands. The difference is that SCRAM allows you to specify the complete CP/M command line as a string variable, to be operated on by CP/M's console command processor as if you had keyed in the line. SCRAM is especially useful in chaining to system programs requiring an extensive command sequence.

The two subroutines are written for Microsoft's Macro-80 assembler, to link with BASCOM compilations using the LINK-80 linking loader. I have used Zilog mnemonics to make use of Z-80 instructions not available in the 8080, the most important of which is the block move, LDIR.

If your CPU chip is an 8080 or 8085, you must find another way to perform the non-8080 instructions, such as writing a program loop to substitute for LDIR. You will also have to transliterate into Intel mnemonics if you want the assembler to catch the errors when you try to use instructions that cannot be executed. (For help in the translation, see, for example, Kathe Spracklen's book, *Z-80 and 8080 Assembly Language Programming*.)

Passing Parameter

Before I discuss the subroutines, it might be well to consider the manner in which variables are "passed" between the BASIC program and an assembly-language subroutine.

You have to tell the subroutine where to find the variables it is to use. You do this as part of the CALL statement. Imagine a subroutine, named DOESIT, that expects to get two variables, do something with them and return the result. Suppose the two variables DOESIT does it to are ALPHA and BETA, and the result (which has to have a name so you can use it later in the BASIC program) is GAMMA. All you write in the BASIC program is: CALL DOESIT(ALPHA,BETA, GAMMA).

The subroutine can't read your BASIC program, but Microsoft has a convention for passing parameters. This is given in Microsoft's BASIC-80 (release 5.0) reference manual, Appendix C, but a little review won't hurt.

When the compiler and link-loader do their stuff with the CALL command, the addresses of the variables are passed to the subroutine. These are the same addresses that would be returned to you if you had used the VARPTR function for those variables and stayed in BASIC. On subroutine calls, the addresses are passed in the internal registers of the CPU chip. For three or fewer variables, the address of the first named variable in the calling statement will be in register pair HL, the second in DE and the third in BC. (For more than three variables, you had better study Appendix C very carefully.)

Once the subroutine has these addresses, it has to know—in great detail—what to do with them. There is nobody but you to check for mismatched types and other such syntax errors. You must know what kind of variable to expect, as well as its internal representation, before you can write the subroutine.

What follows will be kept simple. Since I find compiled BASIC adequate for number crunching, I haven't had any need to write subroutines involving floating-point variables (which have the hardest internal representation to understand). So from here on in, we will consider only string variables. For the two subroutines in this article, we will consider only one string variable per subroutine.

For a string variable, the address passed in register pair HL (if there is only one) points to a block of three consecutive bytes in RAM. The number in HL is the address of the first byte, which contains the count (in binary) of the number of characters in the string. The next two bytes of this

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string pointer contain the starting address of the actual string. Thus, the subroutine gets a pointer (address) pointing to a string pointer, which points to the string itself.

Each time BASCOM finds a newly-named string variable during the compilation, it sets up a string pointer in the data segment (DSEG) of the program space. If the string is a *literal* (that is, a string embedded in the program text), the BASCOM compiler will put it in DSEG and enter its location in the string pointer. However, if the string is a variable to be obtained from an INPUT statement, or from operating on other string variables or literals, BASCOM will initialize the string pointer to all zeros.

The first time you execute a command giving a value to that string variable, the actual string will be written in string space—the available RAM not taken up by your program or by BASIC's stack—and the string pointer will be changed to suit. If you change the value of that same-named string variable later in the executed program, the new string will be written somewhere else in string space, and the address in its string pointer will be changed again. Continued reuse keeps filling up string space, leaving garbage (no longer valid strings) laying around in RAM. When things get tight, the BASIC storage manager does a clean-up job to salvage all that abandoned space.

```
                                         TITLE   PICKUP

                                  ;Written by M. L. Lesser 10-25-80 (rev. 2-28-81)
                                  ;Written in Zilog Z80 mnemonics.
                                  ;Assembled with Microsoft MACRO-80 release 3.36.

                                  ;PICKUP is to be linked with a BASCOM program.  It
                                  ;moves the rest of the command line to a string
                                  ;literal available to the program.

  0000                            BASE    EQU 0000          ;Standard CP?M location
  0080                            TBUFF   EQU BASE + 80H

  0000'                           PICKUP::                  ;Entry point
  0000'   36 00                           LD (HL),0         ;Set pointer to zero length
  0002'   11 0000"                        LD DE,TEMP        ;Address of string literal
  0005'   23                              INC HL            ;Store address of string
  0006'   73                              LD (HL),E         ;   in string pointer
  0007'   23                              INC HL
  0008'   72                              LD (HL),D
  0009'   3A 0080                         LD A,(TBUFF)      ;Check string length
  000C'   FE 00                           CP 0              ;Is it zero?
  000E'   C8                              RET Z             ;If so, return
  000F'   06 00                           LD B,0            ;Put string length in BC
  0011'   4F                              LD C,A
  0012'   11 0080                         LD DE,TBUFF       ;tbuff address in DE
  0015'   13                      BLANK:  INC DE            ;Skip leading blank
  0016'   1A                              LD A,(DE)         ;Check next character
  0017'   FE 20                           CP ' '            ;Is it a blank?
  0019'   20 04                           JR NZ,MOVE        ;If not, move string
  001B'   0D                              DEC C             ;If so, reduce count
  001C'   C8                              RET Z             ;Return if zero count
  001D'   18 F6                           JR BLANK          ;Else try again
  001F'   2B                      MOVE:   DEC HL            ;Restore string pointer
  0020'   2B                              DEC HL            ;   in HL
  0021'   71                              LD (HL),C         ;Store string length
  0022'   EB                              EX DE,HL          ;Source address to HL
  0023'   11 0000"                        LD DE,TEMP        ;Sink address in DE
  0026'   ED B0                           LDIR              ;Block-move string
  0028'   C9                              RET

  0029'                                   DSEG              ;Data space
  0000"                           TEMP:   DEFS 128          ;Enough for maximum tbuff
                                          END

Symbols:
BASE    0000    BLANK   0015'   MOVE    001F'   PICKUP  0000I'
TBUFF   0080    TEMP    0000"

BASE      11#     12
BLANK     27#     33
MOVE      30      34#
PICKUP    14#
TBUFF     12#     21      26
TEMP      16      38      43#
```

Listing 1. PICKUP subroutine (all examples are written for Microsoft's BASCOM running under CP/M).

The Subroutines

The two subroutines shown here take advantage of the procedure CP/M uses in loading a program. CP/M has a section known as the command control processor (CCP), which is used only for interpreting the initial calls you make on the system from the keyboard. CCP is considered to be expendable by any program. For example, the BASIC storage management routine (that was linked with your program from the system library, BASLIB.REL) starts building the stack down from where CCP ended, and string space up from where your program space ended.

BASIC always knows where to put its stack. The lowest address used by the permanent part of CP/M—the basic disk operating system (BDOS) entry address—can be found in zero-page locations 0006 and 0007. You will have to take my word for this, because if you load in DDT (or any other monitor that writes over CCP)

Listing 2. SCRAM subroutine.

```
                                        TITLE SCRAM

                                  ;Written by M. L. Lesser, January 17, 1981
                                  ;Written in Zilog Z80 mnemonics,
                                  ;Assembled with Microsoft MACRO-80 release 3.36

                                  ;SCRAM is to be linked with a BASCOM program.
                                  ;If SCRAM is used instead of the BASCOM RUN or
                                  ;CHAIN commands, it provides a pseudo "auto-load"
                                  ;by reloading the CCP and moving the string
                                  ;variable into the command buffer.
                                  ;Use SCRAM for chaining to system programs that
                                  ;require additional parameters.

                                  ;WARNING:  ALL FILES OPENED BY THE BASIC PROGRAM
                                  ;          MUST BE CLOSED BEFORE CALLING SCRAM

                                  ;NOTE:  SCRAM will not operate correctly with a
                                  ;       monitor (such as DDT) loaded under BDOS.

  0000                            BASE    EQU 0000          ;Standard CP/M location

                                  ;Contents of zero-page locations used:
                                  ;
  0001                            BOOTP   EQU BASE + 01    ;Pointer to WBOOT
  0004                            DRIVNO  EQU BASE + 04    ;Default drive number
  0005                            BDOS    EQU BASE + 05    ;Jump to BDOS entry
  0080                            TBUFF   EQU BASE + 80H   ;Start of temporary buffer

                                  ;BDOS function used by SCRAM:
                                  ;
```

More

Listing 2 continued.

```
 32    001A                        LDDMA    EQU 26           ;Set DMA Address
 33
 34    0011                        NSECTS   EQU 17  ;CCP on  16 sectors + 6 bytes!
 35
 36    0000'                       SCRAM::                   ;Entry point
 37                                                          ;Build dummy command line
 38    0000'   7E                           LD A,(HL)        ;Put length of string
 39    0001'   32 0000"                     LD (DUMCOM),A    ;  in dummy command line
 40    0004'   06 00                        LD B,0           ;Set up BC for block move
 41    0006'   4F                           LD C,A
 42    0007'   23                           INC HL           ;Put string address in DE
 43    0008'   5E                           LD E,(HL)
 44    0009'   23                           INC HL
 45    000A'   56                           LD D,(HL)
 46    000B'   EB                           EX DE,HL         ;String address in HL
 47    000C'   11 0001"                     LD DE,DUMCOM+1   ;Destination address in DE
 48    000F'   ED B0                        LDIR             ;Move string to dummy line
 49    0011'                       SETUP:
 50    0011'   31 0100                      LD SP,TBUFF+80H  ;Use tbuff for stack
 51    0014'   2A 0001                      LD HL,(BOOTP)
 52    0017'   16 00                        LD D,0
 53    0019'   1E 15                        LD E,15H         ;Calculate CBIOS "HOME"
 54    001B'   19                           ADD HL,DE        ;   address = WBOOT + 15H
 55    001C'   22 0080"                     LD (HOMEP),HL    ;Pointer to HOME jump entry

 56    001F'   1E 03                        LD E,3           ;Calculate CBIOS "SELDSK"
 57    0021'   19                           ADD HL,DE        ;  = HOME + 03
 58    0022'   22 0082"                     LD (DISKP),HL    ;Pointer to SELDSK entry
 59    0025'   1E 06                        LD E,06          ;CBIOS "SETSEC" jump
 60    0027'   19                           ADD HL,DE        ;  = SELDSK + 06
 61    0028'   22 0084"                     LD (SECP),HL     ;Load pointer to entry
 62    002B'   19                           ADD HL,DE        ;READ = SETSEC + 06
 63    002C'   22 0086"                     LD (READP),HL
 64    002F'   2A 0006                      LD HL,(BDOS+1)   ;Jump address to BDOS
 65    0032'   11 F7FA                      LD DE,0F7FAH     ;CCP entry =
 66    0035'   19                           ADD HL,DE        ;    BDOS entry - 806H
 67    0036'   22 0088"                     LD (CPMBP),HL    ;Pointer to CCP entry
 68    0039'   0E 00                        LD C,0
 69    003B'   2A 0082"                     LD HL,(DISKP)
 70    003E'   CD 0099'                     CALL CBIOS       ;Select Disk A
 71    0041'   2A 0080"                     LD HL,(HOMEP)
 72    0044'   CD 0099'                     CALL CBIOS       ;Select track 0
 73    0047'   ED 5B 0088"                  LD DE,(CPMBP)    ;Initial DMA address
 74    004B'   06 11                        LD B,NSECTS
 75    004D'   0E 02                        LD C,2           ;First sector to read
 76    004F'                       LOAD:                     ;Pseudo warm start
 77    004F'   D5                           PUSH DE          ;Save DMA address
 78    0050'   C5                           PUSH BC          ;Save sector data
 79    0051'   0E 1A                        LD C,LDDMA
 80    0053'   CD 0005                      CALL BDOS        ;Set DMA address
 81    0056'   C1                           POP BC           ;Recall sector data
 82    0057'   C5                           PUSH BC          ;Save it for later
 83    0058'   2A 0084"                     LD HL,(SECP)
 84    005B'   CD 0099'                     CALL CBIOS       ;Set next sector
 85    005E'   2A 0086"                     LD HL,(READP)
 86    0061'   CD 0099'                     CALL CBIOS       ;Read it in
 87    0064'   FE 00                        CP 0
 88    0066'   20 A9                        JR NZ,SETUP      ;If error, try again
 89    0068'   C1                           POP BC           ;Recall old sector data
 90    0069'   05                           DEC B            ;DEC sector count
 91    006A'   28 09                        JR Z,FINISH
 92    006C'   0C                           INC C            ;Next sector
 93    006D'   D1                           POP DE           ;Recall old DMA address
 94    006E'   21 0080                      LD HL,80H
 95    0071'   19                           ADD HL,DE
 96    0072'   EB                           EX DE,HL         ;Next DMA address
 97    0073'   18 DA                        JR LOAD
 98    0075'                       FINISH:
 99    0075'   2A 0088"                     LD HL,(CPMBP)    ;Calculate CCP auto-load
100    0078'   11 0007                      LD DE,7          ;  entry = CPMB + 7
101    007B'   19                           ADD HL,DE
102    007C'   11 0000"                     LD DE,DUMCOM     ;Image of Command Line
103    007F'   EB                           EX DE,HL         ;Set up for move
104    0080'   7E                           LD A,(HL)
105    0081'   3C                           INC A            ;Must move 'length' + 1
106    0082'   06 00                        LD B,0
107    0084'   4F                           LD C,A
108    0085'   ED B0                        LDIR             ;Move DUMCOM to Command Line
109    0087'   3E 00                        LD A,0
110    0089'   12                           LD (DE),A        ;Add null to Command Line

111    008A'   11 0080                      LD DE,TBUFF
112    008D'   0E 1A                        LD C,LDDMA
113    008F'   CD 0005                      CALL BDOS        ;Reset DMA address to tbuff
114    0092'   3A 0004                      LD A,(DRIVNO)    ;Restore logged-on disk
115    0095'   4F                           LD C,A
116    0096'   2A 0088"                     LD HL,(CPMBP)    ;Jump to CCP entry
117    0099'   E9                  CBIOS:   JP (HL)
118                                ;
119                                ;
120    009A'                                DSEG             ;Data Space
121    0000"                       DUMCOM:  DEFS 128         ;Image of Command Line
122                                ;
123                                ;Pointers to CBIOS jump table:
124                                ;
125    0080"   0000                HOMEP:   DEFW 0           ;to "HOME"
126    0082"   0000                DISKP:   DEFW 0           ;to "SELDSK"
127    0084"   0000                SECP:    DEFW 0           ;to "SETSEC"
128    0086"   0000                READP:   DEFW 0           ;to "READ"
129                                ;
130                                ;Pointer to CCP entry (CPMB):
131                                ;
```

More →

to look at those locations, the monitor will change the pointer in them to *its* lowest permanent address.

Anything you type in after the system prompt goes to the CCP command buffer. This is the same buffer that would carry a prerecorded command on boot if you were using CP/M's auto-load feature. (See "For CP/M: Automatic Program Execution on Start-Up," by Jon Lindsay, *Microcomputing*, January 1981, p. 184.) When you type in the carriage return, CCP goes to work.

CCP considers everything in the command buffer ahead of the first blank to be the name of the program called. So it tries to load a ".COM" file with that same name into the "transient program area." If it finds the program and loads it, CCP puts the rest of the command line into CP/M's "temporary buffer" (tbuff), which starts at 0080H. The first byte in tbuff is the number (in binary) of valid characters moved. This is followed by the text, including that first blank. When CCP is done, it transfers control to the start of the program you just called. (For additional details, see the Digital Research manual, *CP/M Interface Guide*.)

PICKUP (Listing 1) makes a BASIC string literal out of that "rest of the command line" after stripping off the leading blank(s). It moves the remaining valid characters to a location within the subroutine itself and changes the string pointer to fit. If there was nothing in the command line after the program name, PICKUP will return a zero-length string to BASIC. As written, the subroutine assumes a standard CP/M with the zero-page origin at address 0000. If your CP/M has a zero-page offset, use that address for the value of BASE given in line 11.

You will notice two PICKUPs in the listing. The first, with the pseudo-op "TITLE," is the name of the module. The Microsoft library manager utility, LIB-80, works with module names. The second PICKUP, the label with the two colons in line 14, is the entry point to the subroutine. The CALLs from BASIC programs are to entry labels. If any module has more than one entry point, you CALL whichever entry label is pertinent. I usually keep the module name and the main entry point name the same, to avoid confusing myself.

Unlike most programs running under CP/M, SCRAM (Listing 2) by-

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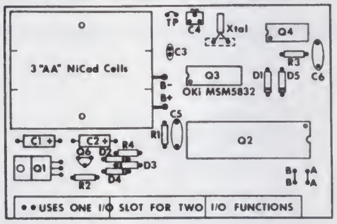

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Listing 2 continued.

```
      132     0088"   0000                         CPMBP:  DEFW 0
      133                                          ;
      134                                                  END

   Symbols:
   BASE     0000    BDOS     0005    BOOTP    0001     CBIOS    0099'
   CPMBP    0088"   DISKP    0082"   DRIVNO   0004     DUMCOM   0000"
   FINISH   0075'   HOMEP    0080"   LDDMA    001A     LOAD     004F'
   NSECTS   0011    READP    0086"   SCRAM    0000I'   SECP     0084"
   SETUP    0011'   TBUFF    0080

   BASE        21#       25        26         27         28
   BDOS        27#       64        80        113
   BOOTP       25#       51
   CBIOS       70        72        84         86        117#
   CPMBP       67        73        99        116        132#
   DISKP       58        69       126#
   DRIVNO      26#      114
   DUMCOM      39        47       102        121#
   FINISH      91        98#
   HOMEP       55        71       125#
   LDDMA       32#       79       112
   LOAD        76#       97
   NSECTS      34#       74
   READP       63        85       128#
   SCRAM       36#
   SECP        61        83       127#
   SETUP       49#       88
   TBUFF       28#       50       111
```

Listing 3. LINK utility.

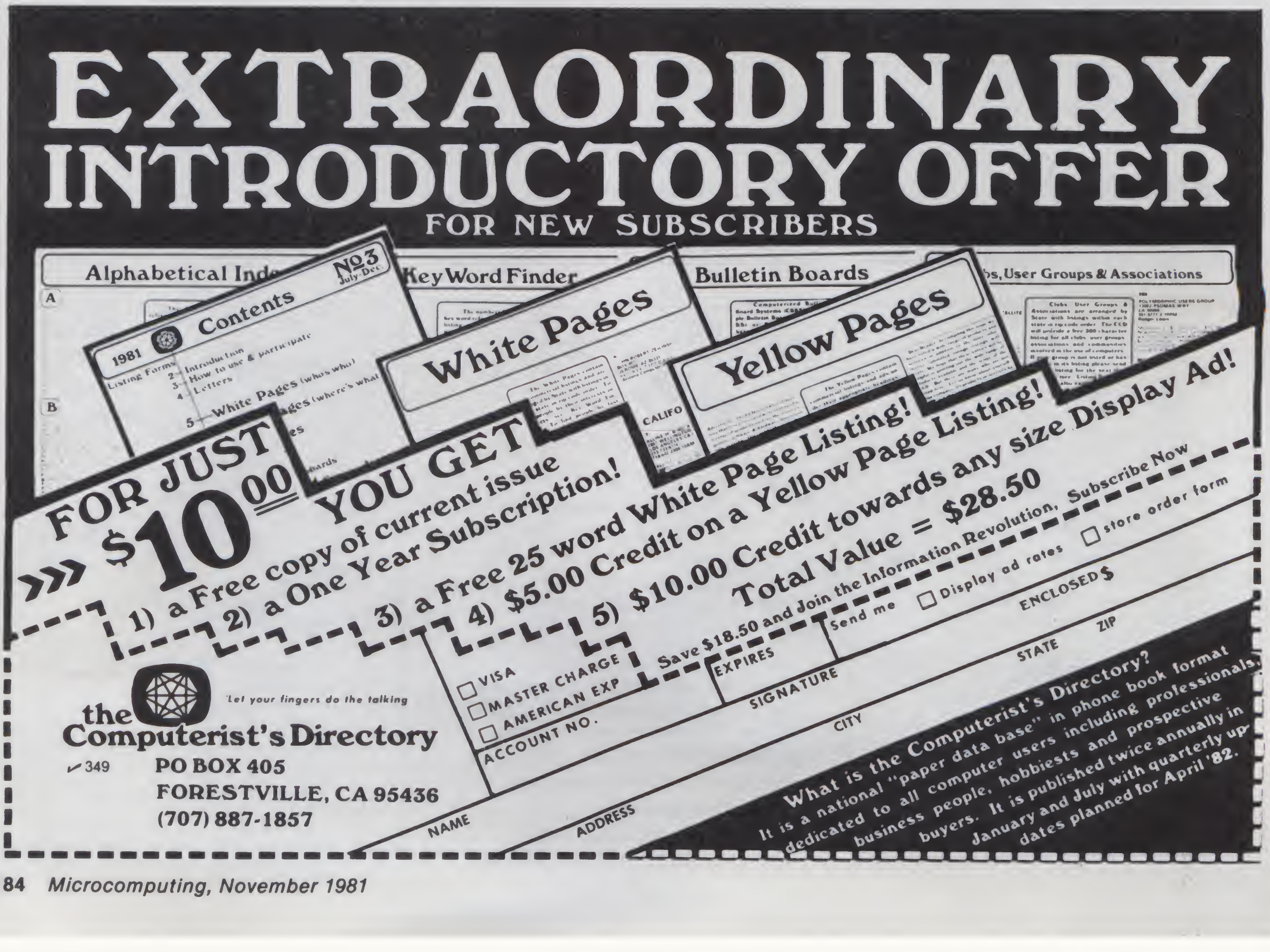
```
00100  '                        ****************
00110  '                        ***   LINK   ***
00120  '                        ****************
00130  '
```

More →

passes Digital Research's portion of the operating system, BDOS, to call directly on the facilities of the hardware-dependent Customized Basic I/O System (CBIOS).

BDOS communicates with the specific hardware making up your system by using a series of jump commands located in the CBIOS jump table. The Digital Research manual, *CP/M System Alteration Guide*, gives the relative location of each entry in the table and the action CBIOS must take for each call. The absolute address of one of the entries, WBOOT, is stored in zero-page locations 0001 and 0002.

SCRAM uses this information to build a set of pointers to the CBIOS functions it needs. It calculates the starting address of CCP by subtracting 0806H from the BDOS entry-point address. SCRAM then overlays BASIC's stack and upper string space by reloading CCP from the A disk, moves the string variable that is to become the command line into the CCP command buffer, and finishes by passing control to the CCP entry point. CP/M then takes over, fooled into thinking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it has just received a warm boot from a disk with an auto-load message.

Strictly speaking, SCRAM is not a subroutine; it doesn't have a return to the calling program. However, BASIC doesn't know this, so SCRAM is called with the usual subroutine CALL.

Since it makes use of CP/M's internal structure, SCRAM probably cannot be used, unmodified, with any other operating system—not even those claimed to be "compatible" with CP/M. Although it is written to be independent of the memory size of your system and the initial address of your CCP, it does make use of known locations in the zero page. If your version of CP/M has a zero-page offset, change the value of BASE in line 21.

The Utilities

Utility programs are supposed to make life easier for the programmer. That is why I wrote the two shown here.

Debugging can be one of the most frustrating activities known to mankind. Late one night, after the third recompilation and relink in 15 minutes, I began to make operator errors

Listing 3 continued.

```
00140   '       Written by M. L. Lesser, January 17, 1981
00150   '       Written in Microsoft BASIC-80 version 5.2
00160   '       Compiled with BASCOM 5.2, switch /Z
00170   '
00180   '       This program link-loads <filename.REL> produced by
00190   '       the BASCOM BASIC-80 compiler with any called assembly-
00200   '       language subroutines from MYLIB.REL.  Input command
00210   '       is "LINK <dev:filename>" typed on the console.
00220   '       Output is <filename.COM>, and is stored on the drive
00230   '       denoted by "dev:" on the calling command line.
00240   '       To "Load and Go", use <dev:filename/G> on input;
00250   '       Output <filename.COM> will still be written to disk.
00260   '
00270   '       To use, LINK.COM, L80.COM, MYLIB.REL and BASLIB.REL
00280   '       must be on the logged-on drive.  <filename.REL> can
00290   '       be on either drive.
00300   '
00310   '
00400   '       The following are string variables:
00410   '
00420   '               FILENAME        Input <dev:filename>
00430   '               COMMAND         L80 calling sequence
00440   '
00450   '
00500   '       Setup
00510   '
00520   DEFINT I
00530   DEFSTR C,F
00540   '
00550   '
01000   '       Main Program
01010   '
01020   CALL PICKUP(FILENAME)                   'Read rest of comand line
01030   IF LEN(FILENAME) = 0 THEN LINE INPUT "<FILENAME>?  ";FILENAME
                ELSE PRINT "Link-loading " FILENAME
01040   LET I = INSTR(FILENAME,"/")             'Check for /G switch
01050   LET COMMAND = "L80 " + FILENAME
01060   IF I = 0 THEN LET COMMAND = COMMAND + "/E,MYLIB/S,"
                        ELSE LET COMMAND = COMMAND + ",MYLIB/S,"
01070   IF I <> 0 THEN LET FILENAME = LEFT$(FILENAME,I-1)
01080   LET COMMAND = COMMAND + FILENAME + "/N"
01090   CALL SCRAM(COMMAND)                     'Link <filename>
01100   '
```

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in typing the redundant command line that calls LINK-80. So I wrote LINK (Listing 3) to relieve this added source of frustration.

LINK generates the normal LINK-80 command line, either for "load and save" or "load, save and go," depending on whether you use the switch "/G" after the name of the file that is to be linked. To use LINK, you must put all your private subroutines—including PICKUP and SCRAM—in your private library (MYLIB.REL) by using LIB-80. Then, LINK will make sure that any subroutine called in the program being linked is inserted in its proper place.

EDIT (Listing 4) is a cure for the near-fatal bug in Microsoft's EDIT-80, release 2.0. While you are editing your text file, EDIT-80 is building an index file so it can write your final version back to disk when you exit from the editor. Unfortunately, if the text file is very long and the changes extensive, release 2.0 leaves the now-obsolete index behind. While the newly-edited file is correct as written to disk and the compiler or assembler can use it, EDIT-80 can't re-edit it until you have gotten rid of the old index file.

EDIT looks for an index file and kills it if it exists, before using SCRAM to call in EDIT-80 and the file to be edited.

Now, in spite of all the foregoing, you don't *have* to use a compiled BASIC to use assembly-language subroutines. Most BASICs have a USR command. And the interpreter version of BASIC-80 release 5.x allows the use of the same CALL command as does BASCOM. However, there is a major difference in what you can't do with an interpreter.

You can't use subroutines that look for data keyed in with the program call, because that call was made after you were already in BASIC. So you can't use PICKUP with an interpreter BASIC.

You can use SCRAM, but I'm not sure it is worth the effort. With the interpreter, you have to know exactly where to put the subroutine in absolute address space. You can't let the system take care of the messy details for you.

Each interpreted program that uses assembly-language subroutines must contain the absolute addresses in RAM where it will find each subroutine it uses, along with a command to protect the subroutine space from BASIC's storage manager. When you want to run one of these programs, you have to load the necessary subroutines into their proper places *before* you call the BASIC interpreter. The bookkeeping, alone, is more bother than it is worth!

Compare this with using LINK to build the subroutines into the compiled object program. Once linked, any subroutine called from your library is a permanent part of the program that called it, and will load with no further effort on your part.

The ease of making your own extensions to the language is another good reason to use a compiled form of BASIC for your serious applications. ■

```
00100    '               ****************************
00200    '               ***   EDIT-80 CLEAN UP   ***
00300    '               ****************************
00400    '
00500    '
00600    '       Written in BASIC-80 BASCOM 5.2, switches /Z/X
00700    '       Written by M. L. Lesser, 1-25-81
00800    '       Object program filed as EDIT.COM
00900    '
01000    '
01100    '       This program corrects for the bug in EDIT-80 release 2.0
01200    '       by erasing the corresponding .$xx index file before starting
01300    '       a new editing session.
01400    '
01500    '       Input command is: EDIT <FILENAME>.  Output is written
01600    '       to the same drive as <FILENAME>.
01700    '
01800    '       NOTE:  Both EDIT.COM and EDIT80.COM must be on the logged-on
01900    '              drive.  <FILENAME> must specify the disk as part of
02000    '              the command line, if not on the logged-on drive.
02100    '
02200    DEFINT I,J
02300    DEFSTR C,F
02400    ON ERROR GOTO 10000
02500    '
02600    CALL PICKUP(FILENAME)                   'Read rest of command line
02700    IF LEN(FILENAME) = 0 THEN GOTO 3300     'If no <filename> call SCRAM
02800    LET I = INSTR(FILENAME,".")             'Check for filetype
02900    LET J = INSTR(FILENAME,"/")             'Check for switch
03000    IF I = 0 THEN GOSUB 5000                'Insert ".MAC" if no filetype
03100    IF J = 0 OR J - I > 2 THEN LET FILEINDEX = LEFT$(FILENAME,I) +
                 "$" + MID$(FILENAME,I+1,2) ELSE GOSUB 7000
                                                 'Short filetype with switch
03200    KILL FILEINDEX                          'Error if no index file
03300    LET COMMAND = "EDIT80 " + FILENAME
03400    CALL SCRAM(COMMAND)                     'Edit <filename>
03500    '
05000    '       Subroutine:  Insert default filetype ".MAC"
05100    IF J = 0 THEN LET FILENAME = FILENAME + ".MAC"
05200    IF J <> 0 THEN LET FILENAME = LEFT$(FILENAME,J-1) + ".MAC" +
                 MID$(FILENAME,J)
05300    LET I = INSTR(FILENAME,".")
05400    LET J = INSTR(FILENAME,"/")
05500    RETURN
05600    '
07000    '       Subroutine:  For short filetype when switch exists
07100    LET ITEM = J - I - 1
07200    LET FILEINDEX = LEFT$(FILENAME,I) + "$" + MID$(FILENAME,I+1,ITEM)
07300    RETURN
07400    '
10000    '       Error trap
10100    IF ERR = 53 AND ERL = 3200 THEN RESUME NEXT
10200    ON ERROR GOTO 0
10300    '
```

Listing 4. EDIT-80 utility.

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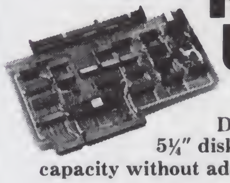

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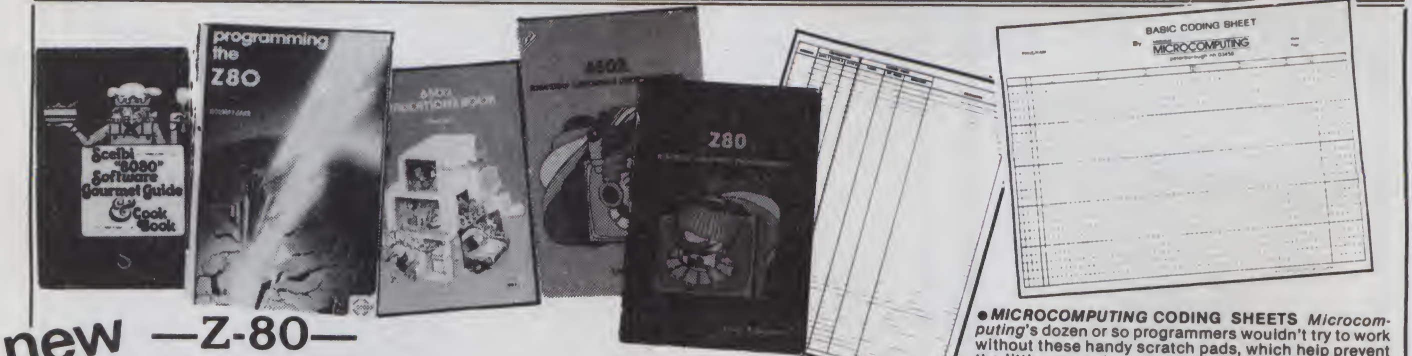

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—6502—

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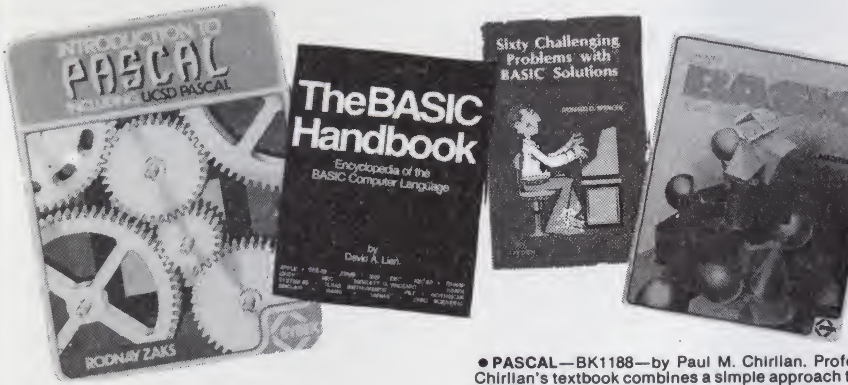
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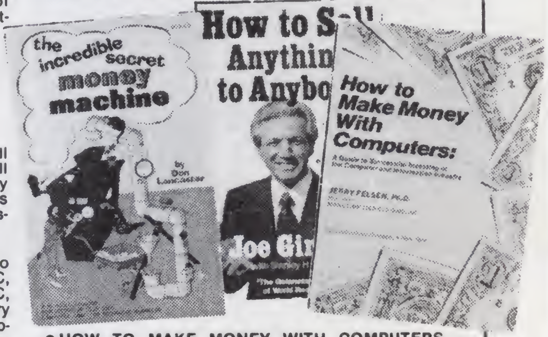
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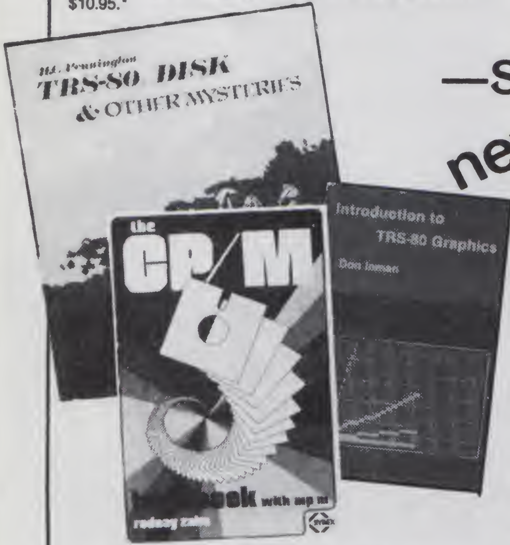
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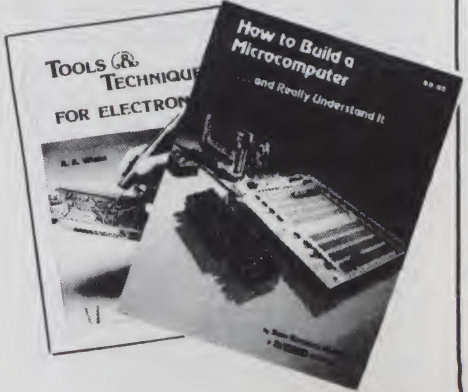
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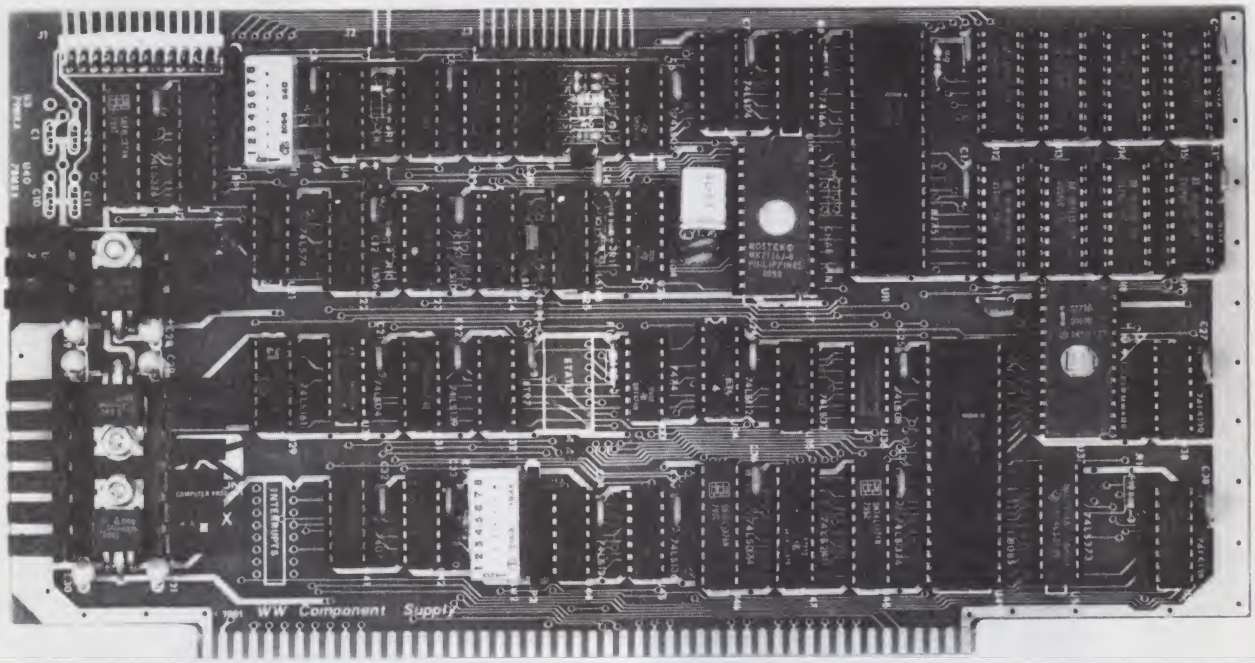

VIO-X

The VIO-X Video I/O Interface for the S-100 bus provides features equal to most intelligent terminals both efficiently and economically. It allows the use of standard keyboards and CRT monitors in conjunction with existing hardware and software. It will operate with no additional overhead in S-100 systems regardless of processor or system speed.

Through the use of the Intel 8275 CRT controller with an onboard 8085 processor and 4k memory, the VIO-X interface operates independently of the host system and communicates via two ports, thus eliminating the need for host memory space. The screen display rate is effectively 80,000 baud.

The VIO-X1 provides an 80 character by 25 line format (24 lines plus status line) using a 5 × 7 character set in a 7 × 10 dot matrix to display the full upper and lower case ASCII alphanumeric 96 printable character set (including true descenders) with 32 special characters for escape and control characters. An optional 2732 character generator is available which allows an alternate 7 × 10 contiguous graphics character set.

The VIO-X2 also offers an 80 character by 25 line format but uses a 7 × 7 character set in a 9 × 10 dot matrix allowing high-resolution characters to be used. This model also includes expanded firmware for block mode editing and light pen location. Contiguous graphics characters are not supported.

Both models support a full set of control characters and escape sequences, including controls for video attributes, cursor location and positioning, cursor toggle, and scroll speed. An onboard Real Time Clock (RTC) is displayed in the status line and may be read or set from the host system. A checksum test is performed on power-up on the firmware EPROM.

Video attributes provided by the 8275 in the VIO-X include:

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- INVERSE CHARACTER
- UNDERLINE CHARACTER or
- ALT. CHARACTER SET
- DIM CHARACTER

The above functions may be toggled together or separately.

The board may be addressed at any port pair in the IEEE 696 (S-100) host system. Status and data ports may be swapped if necessary. Inputs are provided for parallel keyboard and for light pen as well as an output for audio signalling. The interrupt structure is completely compatible with Digital Research's MP/M ®.

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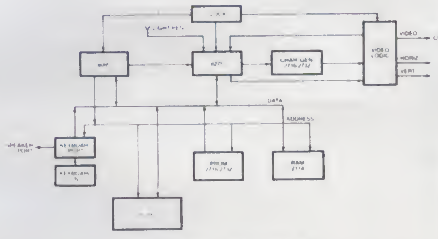

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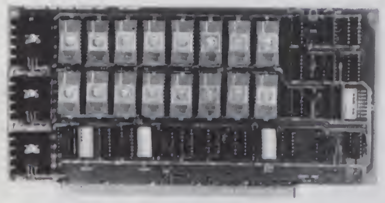

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USES 2716's

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6. On board wait state circuitry if needed.
7. Any or all EPROM locations can be disabled.
8. Double sided PC board, solder-masked, silk-screened.
9. Gold plated contact fingers.
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12. Easy and quick to assemble.

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$\$299^{00}$ KIT

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For SWTPC 6800 - 6809 Buss

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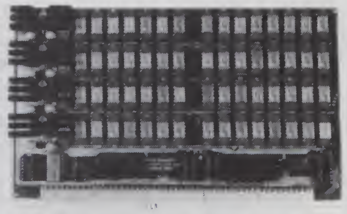

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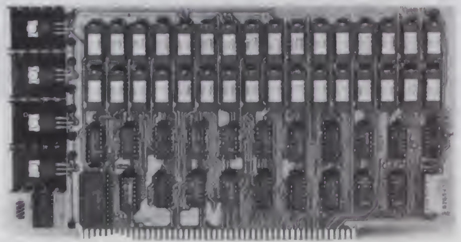

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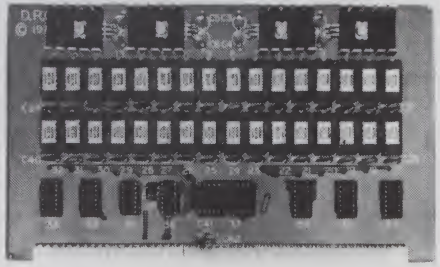

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3. Fully Bypassed
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5. All Parts and Sockets included
6. Low Power Under 1.5 Amps Typical

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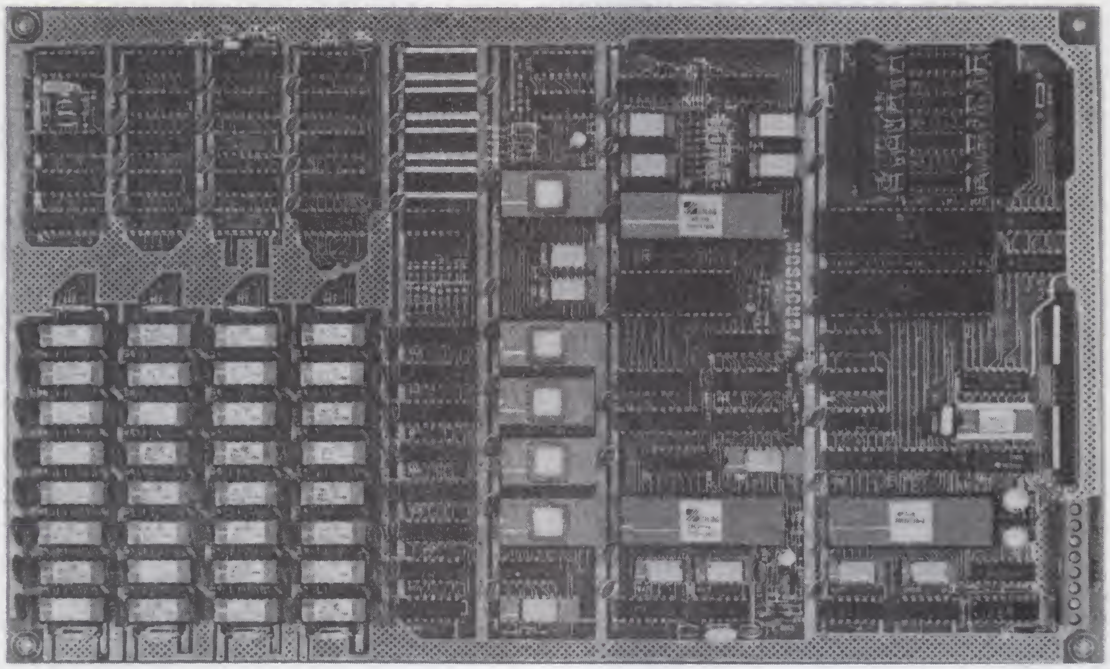

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$649.00** (64K KIT BASIC I/O)

SIZE: 8½ x 13¾ IN.
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REQUIRES: +5V @ 3 AMPS
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Uses industry standard 4116 RAM'S. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software.

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Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 int. Price for all parts and connectors: $85.

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With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true. 5 x 7 Matrix - Upper & Lower Case

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Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $29.95

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: $14.95

SYSTEM COMPARISON

64K RAM KIT	$370.00
80 x 24 Video Kit	365.00
Floppy Disk Controller Kit	235.00
Z-80 CPU Kit	185.95
SER & PAR. I/O	129.95
S-100 Mother Board	45.00
SUB TOTAL	$1330.90

Talk about bangs per buck! The prices shown for S100 kits were taken from the July 1980 BYTE. This will give some basis for comparison between the Big Board and a similar system implementation on the S100 Buss.

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PC BOARD

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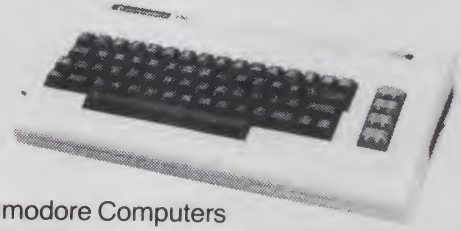

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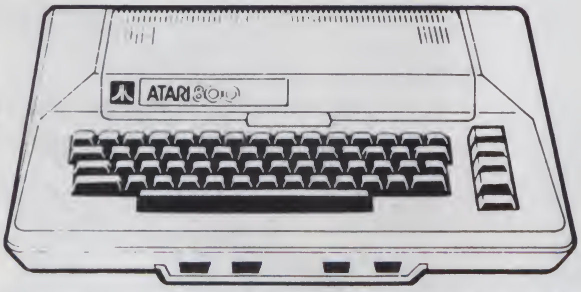

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Flexible Disc 1s Single-Headed Drives Single-Density Media	IBM Compatible (128 B/S, 26 Sectors)	3060	1.99	473071	53428	800506	2305830	FD1-128	FD-1	740 0	S/A 100	15002	FD34-8000	F111111X	421602
	IBM Compatible (128 B/S, 26 Sectors) w/ W P N	3062	2.04	–	–	–	–	–	–	740-0	–	–	FD34-8000	–	–
	IBM Compatible (128 B/S, 26 Sectors) w/ W P N & Hub Ring	3064	2.39	–	–	–	–	–	–	–	–	–	FD34-9000	–	–
	IBM Compatible (128 B/S, 26 Sectors) REVERSIBLE	1729	3.19	473072	54431	–	–	–	FD-2	740/2-0	–	15150	FF34-8000	F171111X	–
	IBM System 6 Compatible	3066	2.04	473077	54561	800509	1669959	–	–	740-0 056	–	15003	FD60-8000	F116111X	–
	IBM Compatible (256 B/S, 15 Sectors)	3109	1.99	473073	–	800584	2305845	–	–	740-3600	–	15006	FD36-8000	F112111X	–
	IBM Compatible (512 B/S, 8 Sectors)	3110	1.99	473074	–	800585	1669954	–	–	–	–	15004	FD60-8000	F113111X	–
	Shugart Compatible 32 Hard Sector	3015	1.99	470901	53802	101/1	–	FH1-32	FD-132	740-32	S/A-101	15025	FD32-8000	–	421322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3087	2.49	–	54491	–	–	–	–	740-32RH	–	–	–	F37A411X	–
	CPT 8000 Compatible	3045	2.69	–	–	–	–	–	–	–	–	15226	–	–	–
Flexible Disc 1d Single Headed Drives Double Density Media	IBM Compatible (128 B/S, 26 Sectors)	3090	2.69	474071	54568	3740/10	–	FD1-128/M2100	FD-10	741-0	–	–	FD34-8000	F131111X	423002
	Soft Sector (128 B/S, 26 Sectors) REVERSIBLE	3093	3.69	–	–	–	–	–	–	–	–	–	–	–	–
	Shugart Compatible 32 Hard Sector	3091	2.69	470801	54596	101/10	–	FH1-32D	–	741-32	S/A-103	15075	FD32-8000	F33A411X	423322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3088	3.09	–	–	–	–	–	–	–	–	–	–	–	–
Flexible Disc 2s Double-Headed Drives Single-Density Media	Soft Sector (128 B/S, 26 Sectors)	3113	3.09	–	54428	800814	1766870	–	–	–	S/A-150	15153	FD10-4026	F121111X	–
	Soft Sector (256 B/S, 15 Sectors)	3106	3.09	473477	54228	800815	2736700	FD2-256D	–	742-0	–	15154	FD10-4015	F122111X	424612
Flexible Disc 2d Double-Headed Drives Double-Density Media	Soft Sector (Unformatted)	3102	3.09	473485	–	DY150	–	FD2-XDM	FD-2D	743-0	–	15103	DD34-4001	–	425002
	Soft Sector (128 B/S, 26 Sectors)	3115	3.09	–	–	–	–	–	–	–	S/A-150	–	–	–	–
	Soft Sector (256 B/S, 26 Sectors)	3103	3.09	473471	54325	800817	1766872	FD2-256D	–	743-0/256	–	15101	DD34-4026	F144111X	425602
	Soft Sector (512 B/S, 15 Sectors)	3114	3.09	473472	54478	800816	1669044	–	–	743-0/512	–	15100	DD34-4016	F145111X	425612
	Soft Sector (1024 B/S, 8 Sectors)	3104	3.09	473473	54485	800819	1669045	–	–	743-0/1024	–	15102	DD34-4008	F147111X	425622
	32 Hard Sector	3105	3.09	470851	–	101/2D	–	FH2-32D	–	743-32	S/A-161	15125	DD32-4000	F34A411X	425322
	Burroughs B-80 Compatible, 32 Hard Sector	3092	3.09	–	–	–	–	–	–	–	–	–	–	F34A811X	–
	Soft Sector (1024 B/S, 8 Sectors) w/ Hub Ring	3116	3.49	–	–	–	–	–	–	–	–	–	–	–	–
	Shugart Compatible, 32 Hard Sector	3181	3.39	–	–	–	–	–	–	–	–	–	DD32-4000	–	–
Flexible Disc FD Memorex 651 or Equiv Drive Compatible	FD VI (Vinyl Jacket)	30712003	2.69	470951	–	FDIV	–	–	FD-165	611-0	–	15026	FD65-1000	F61A111X	–
Mini Flexible Disc 1s 5¼" Single-Headed Drives Single-Density Media	Soft Sector (Unformatted)	3401	1.94	475001	54256	104/1	–	MD1	MD 1	744-0	S/A-104	15300	MD525-01	M11A211X	441002
	10 Hard Sector	3403	1.94	475010	54257	107/1	–	–	MD 110	744-10	S/A-107	15326	MD525-10	M41A211X	441102
	16 Hard Sector	3405	1.94	475016	54258	106/1	–	MH1	MD 116	744-16	S/A-105	15328	MD525-16	M51A211X	441162
	Soft Sector (Unformatted) w/Hub Ring	3431	2.14	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector, w/Hub Ring	3433	2.14	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector, w/Hub Ring	3435	2.14	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 1d 5¼" Single-Headed Drives Double-Density Media	Soft Sector (Unformatted)	3417	2.14	–	54646	104/10	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector	3418	2.14	–	54648	107/10	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector	3419	2.14	–	54652	106/10	–	–	–	–	–	–	MD525-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3481	2.34	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector w/Hub Ring	3483	2.34	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector w/Hub Ring	3485	2.34	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 2d 5¼" Double-Headed Drives Double Density Media	Soft Sector (Unformatted)	3421	2.59	–	54624	104/2D	–	–	–	–	S/A-154	–	MD550-01	–	–
	10 Hard Sector	3423	2.59	–	54627	107/2D	–	–	–	–	S/A-157	–	MD550-10	–	–
	16 Hard Sector	3425	2.59	–	54630	106/2D	–	–	–	–	S/A-155	–	MD550-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3491	2.79	–	–	–	–	–	–	–	–	–	MD550-01	–	–
	10 Hard Sector w/Hub Ring	3493	2.79	–	–	–	–	–	–	–	–	–	MD550-10	–	–
	16 Hard Sector w/Hub Ring	3495	2.79	–	–	–	–	–	–	–	–	–	MD550-16	–	–

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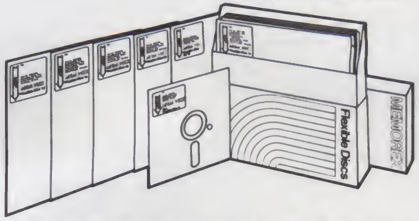

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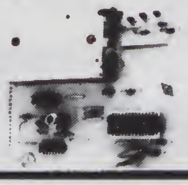

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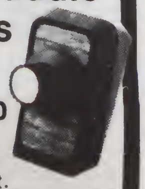

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74LS83	.89
74LS85	1.25
74LS86	.49
74LS90	.69
74LS92	.75
74LS93	.75
74LS95	.99
74LS96	1.15
74LS107	.45
74LS109	.45
74LS112	.45
74LS113	.49
74LS114	.49
74LS122	.89
74LS123	1.25
74LS125	.59
74LS126	.59
74LS132	.99
74LS133	.89
74LS136	.49
74LS138	.89
74LS139	.89
74LS151	.89
74LS153	.89
74LS154	1.75
74LS155	.89
74LS156	.89
74LS157	.89
74LS158	.89
74LS160	1.15
74LS161	1.15
74LS162	1.15
74LS163	1.15
74LS164	1.15
74LS165	1.15
74LS168	1.19
74LS169	1.19
74LS170	1.95
74LS173	.99
74LS174	.99
74LS175	.99
74LS181	2.95
74LS190	1.25
74LS191	1.25
74LS192	1.15
74LS193	1.15
74LS194	1.15
74LS195	1.15
74LS197	1.19
74LS221	1.19
74LS240	1.49
74LS241	1.49
74LS242	1.49
74LS243	1.49
74LS244	1.49
74LS245	2.95
74LS247	1.19
74LS248	1.19
74LS249	1.19
74LS251	.99
74LS253	.99
74LS257	.89
74LS258	.69
74LS260	.69
74LS266	.69
74LS273	1.95
74LS279	.89
74LS283	.89
74LS290	.99
74LS293	.99
74LS298	1.25
74LS352	1.29
74LS353	1.29
74LS365	.69
74LS366	.69
74LS367	.69
74LS368	.69
74LS373	1.95
74LS374	1.95
74LS375	.89
74LS386	.69
74LS393	2.49
74LS399	2.49
74LS670	2.49
81LS95	1.95
81LS97	1.95

74S

74S00	.45
74S02	.45
74S03	.45
74S04	.55
74S05	.55
74S08	.50
74S09	.50
74S10	.45
74S11	.45
74S15	.45
74S20	.45
74S22	.45
74S30	.45
74S32	.55
74S38	1.25
74S40	.50
74S51	.45
74S64	.50
74S65	.50
74S74	.75
74S86	.79
74S112	.79
74S113	.79
74S114	.79
74S124	3.95
74S133	.55
74S134	.69
74S135	1.19
74S136	1.75
74S138	1.35
74S139	1.35
74S140	.79
74S151	1.35
74S153	1.35
74S157	1.35
74S158	1.35
74S160	2.95
74S174	1.59
74S175	1.59
74S188	2.95
74S194	1.95
74S195	1.95
74S196	1.95
74S240	2.95
74S241	2.95
74S242	3.25
74S243	3.25
74S244	3.25
74S251	1.45
74S253	1.45
74S257	1.35
74S258	1.35
74S260	.79
74S280	2.95
74S287	3.25
74S288	2.75
74S373	3.49
74S374	3.49
74S387	2.95
74S471	10.95
74S472	10.95
74S473	10.95
74S474	12.95
74S475	12.95
74S570	5.95
74S571	5.95
74S572	9.95
74S573	9.95
74S940	3.15
74S941	3.15

CA—LINEAR

CA3010H	.99
CA3013H	2.15
CA3023H	3.25
CA3035H	2.49
CA3039H	1.35
CA3046N	1.30
CA3059N	3.25
CA3060N	3.25
CA3080H	1.25
CA3081N	2.00
CA3082N	2.00
CA3083N	1.60
CA3086N	.85
CA3089N	3.75
CA3096N	3.95
CA3130H	1.39
CA3140H	1.25
CA3160H	1.25
CA3401N	.59
CA3600N	3.50

CD—CMOS

CD4000	.39
CD4001	.39
CD4002	.39
CD4006	1.19
CD4007	.25
CD4009	.49
CD4010	.49
CD4011	.39
CD4012	.25
CD4013	.49
CD4014	1.39
CD4015	1.19
CD4016	.59
CD4017	1.19
CD4018	.99
CD4019	.49
CD4020	1.19
CD4021	1.39
CD4022	1.19
CD4023	.29
CD4024	.79
CD4025	.23
CD4026	2.95
CD4027	.69
CD4028	.89
CD4029	1.49
CD4030	.49
CD4034	3.49
CD4035	.99
CD4040	1.49
CD4041	1.49
CD4042	.99
CD4043	.89
CD4044	.89
CD4046	1.79
CD4047	2.50
CD4048	1.35
CD4049	.49
CD4050	.69
CD4051	1.19
CD4052	1.19
CD4053	1.19
CD4056	2.95
CD4059	9.95
CD4060	1.49
CD4066	.79
CD4068	.39
CD4069	.45
CD4070	.55
CD4071	.49
CD4072	.49
CD4073	.39
CD4075	.39
CD4076	1.39
CD4078	.55
CD4081	.39
CD4082	.39
CD4093	.99
CD 4098	2.49
CD4506	.75
CD4507	.99
CD4508	3.95
CD4510	1.39
CD4511	1.29
CD4512	1.49
CD4514	3.95
CD4515	2.95
CD4516	1.49
CD4518	1.79
CD4519	.89
CD4520	1.29
CD4526	1.79
CD4528	1.79
CD4529	1.95
CD4543	2.79
CD4562	11.95
CD4566	2.79
CD4583	2.49
CD4584	.75
CD4723	1.95
CD4724	1.95
MC14409	17.95
MC14410	18.95
MC14411	15.95
MC14412	15.95
MC14419	7.95
MC14433	15.95
MC14538	2.49
MC14541	1.95

Phone Tunes

As Seen on "Good Morning America"

Replaces the Telephone Ringer Bell with a Selection of 30 Familiar Tunes

Each Unit will play any of the following tunes:

- Rule Brittania
- O Canada
- Colonel Bogey
- Westminister Chimes
- Mexican Hat Dance
- Twinkle, Twinkle Little Star
- Deutschlandlied
- God Save the Queen
- Close Encounters
- Happy Birthday
- Wedding March
- Jingle Bells
- Auld Lang Syne
- Soldiers Chorus
- Sailor's Hornpipe
- Charge!
- Greensleeves
- Lorelei
- Eyes of Texas
- Star Spangled Banner
- Oranges and Lemons
- Wilhelmus
- Mozart Sonata
- Pomp & Circumstance
- William Tell Overture
- Bach Toccata in D Minor
- Shave and a Haircut
- Blue Danube Waltz
- Beethoven's 5th
- La Marseillaise

FEATURES

Replaces monotonous telephone ringer bell. Easily connects to any standard telephone. Can be used alongside regular phone or replace a remote ringer elsewhere in building or outside. FCC approved. Can be used on any telephone system — worldwide. Use a different tune to identify extension phones. Microprocessor controlled. Adjustable volume control and variable tune speed control. Operates on two 9-volt batteries or AC Adapter (not included).

PT030 Phone Tunes $49.95
AD30 AC Adapter $8.95

DISCRETE LEDS

XC556R	.200"	red	5/$1
XC556G	.200"	green	4/$1
XC556Y	.200"	yellow	4/$1
XC556C	.200"	clear	4/$1
XC22R	.200"	red	5/$1
XC22G	.200"	green	4/$1
XC22Y	.200"	yellow	4/$1
MV10B	.170"	red	4/$1
MV50	.085"	red	6/$1
XC209R	.125"	red	5/$1
XC209G	.125"	green	4/$1
XC209Y	.125"	yellow	4/$1
XC526R	.185"	red	5/$1
XC526G	.185"	green	4/$1
XC526Y	.185"	yellow	4/$1
XC526C	.185"	clear	4/$1

.200(T1¾) Red/Green

Diffused Bi-Color LED

Part No.	1-99	100+
XC5491	.79	.69

XC556 RED LED, METAL MTG. HDW. 2-6" LEADS.

RL-2 . . $.39 ea. or 3/$1.00

DISPLAY LEDS

C.A. — Common Anode
D.D. — Double Digit
C.C. — Common Cathode
RHD — Right Hand Decimal

Type	Polarity	Ht	Price
MAN 1	C.A.—red	.270	2.95
MAN 2	5x7 D.M.—red	.300	4.95
MAN 3	C.C.—red	.125	.25
MAN 52	C.A.—green	.300	.99
MAN 54	C.C.—green	.300	.99
MAN 71	C.A.—red	.300	.75
MAN 72	C.A.—red	.300	.75
MAN 74	C.C.—red	.300	1.25
MAN 82	C.A.—yellow	.300	.49
MAN 84	C.C.—yellow	.300	.99
MAN 3620	C.A.—orange	.300	.49
MAN 3630	C.A.—orange ± 1	.300	.99
MAN 3640	C.C.—orange	.300	.99
MAN 4610	C.A.—orange	.400	.99
MAN 6610	C.A.—orange—DD	.560	.99
MAN 6630	C.A.—orange ± 1	.560	.99
MAN 6640	C.C.—orange—DD	.560	.99
MAN 6650	C.C.—orange ± 1	.560	.99
MAN 6660	C.A.—orange	.560	.99
MAN 6710	C.A.—red—DD	.560	.99
MAN 6740	C.C.—red—DD	.560	.99
MAN 6750	C.C.—red ± 1	.560	.99
DLO304	C.C.—orange	.300	1.25
DLO307	C.A.—orange	.300	1.25
DLG500	C.C.—green	.500	1.25
DLG507	C.A.—green	.500	1.25
DL704	C.C.—red	.300	1.25
DL707	C.A.—red	.300	1.25
DL728	C.C.—red	.500	1.49
DL741	C.A.—red	.600	1.25
DL747	C.A.—red	.600	1.49
DL750	C.C.—red	.600	1.49
DLO847	C.A.—orange	.800	1.49
DLO850	C.C.—orange	.800	1.49
DL33B	C.C.—red	.110	.35
FND358	C.C. ± 1	.357	.99
FND357	C.C.	.357	.75
FND500	C.C. (FND503)	.500	.99
FND507	C.A. (FND510)	.500	.99
HDSP-3401	C.A.—red	.800	1.50
HDSP-3403	C.C.—red	.800	1.50
HDSP-3406	C.C. red ±1	.800	1.50
5082-7751	C.A.,R.H.D.—red	.430	1.25
5082-7760	C.C.,R.H.D.—red	.430	1.25
5082-7300	4x7 Numeric (RHD)	.600	22.00
5082-7302	4x7 Numeric (LHD)	.600	22.00
5082-7340	4x7 Hxdcl. (0-9/A-F)	.600	22.50
4N28	Photo Xsistor Opto-isol.		.69
LIT-1	Photo Xsistor Opto-isol.		.69
MOC3010	Optically Isol. Triac Driver		1.25

SOCKETS — Test TEXTOOL Sockets — RECEPTACLES

ZERO INSERTION FORCE

- * Nickel Boron Plating
- * G.F. PSF Plastic Body
- * For testing IC's

Part No.	Pins	Price
214-3339	14 pin	5.95
216-3340	16 pin	6.49
218-3341	18 pin	7.95
220-3342	20 pin	8.95
222-3343	22 pin	9.95
224-3344	24 pin	9.75
228-3345	28 pin	11.95
240-3346	40 pin	12.95

- * Nickel Boron Plating
- * G.F. PSF Plastic Body
- * Wire Wrap Contacts

Part No.	Pins	Price
214-3592	14 pin	9.75
216-3593	16 pin	9.95
218-3594	18 pin	10.95
220-3595	20 pin	11.95
222-3596	22 pin	12.95
224-3597	24 pin	12.75
228-3598	28 pin	13.95
240-3599	40 pin	15.95

LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.53	.58
40 pin LP	.63	.62	.61

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS – 5%

ASST. 1	5ea.	10 Ohm 12 Ohm 15 Ohm 18 Ohm 22 Ohm 27 Ohm 33 Ohm 39 Ohm 47 Ohm 56 Ohm	50pcs.	$1.95
ASST. 2	5ea.	68 Ohm 82 Ohm 100 Ohm 120 Ohm 150 Ohm 180 Ohm 220 Ohm 270 Ohm 330 Ohm 390 Ohm	50pcs.	$1.95
ASST. 3	5ea.	470 Ohm 560 Ohm 680 Ohm 820 Ohm 1K 1.2K 1.5K 1.8K 2.2K 2.7K	50pcs.	$1.95
ASST. 4	5ea.	3.3K 3.9K 4.7K 5.6K 6.8K 8.2K 10K 12K 15K 18K	50pcs.	$1.95
ASST. 5	5ea.	22K 27K 33K 39K 47K 56K 68K 82K 100K 120K	50pcs.	$1.95
ASST. 6	5ea.	150K 180K 220K 270K 330K 390K 470K 560K 680K 820K	50pcs.	$1.95
ASST. 7	5ea.	1M 1.2M 1.5M 1.8M 2.2M 2.7M 3.3M 3.9M 4.7M 5.6M	50pcs.	$1.95
ASST. 8R		Includes Resistor Assts. 1-7 (350 pcs.)		$10.95 ea.

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INTERSIL

Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	24.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	29.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/Kit*	Tone Generator Chip, XTL	12.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	13.95
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217IJI	4-Digit LED Up/Down Counter	12.95
7218CIJI	8-Digit Univ. LED Drive	10.95
7224IPL	LCD 4½ Digit Up Counter DRI	11.25
7226AIJL	8-Digit Univ. Counter	31.95
7226AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
7555IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator 5MV	2.25
7612BCPA	CMOS Op Amp Ext. Cmvr. 5MV	2.95
7621BCPA	CMOS Dual Op Amp Comp. 5MV	3.95
7631CCPE	CMOS Tri Op Amp Comp. 10MV	5.35
7641CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7642CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7660CPA	Voltage Converter	2.95
8038CCPD	Waveform Generator	4.95
8048CCPE	Monolithic Logarithmic Amp	21.60
8069CCQ	50ppm Band—GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.95
8212CPA	Volt Ref/Indicator	2.95

74C

74C00	.39
74C02	.39
74C04	.39
74C08	.39
74C10	.39
74C14	.75
74C20	.39
74C30	.39
74C42	1.39
74C48	1.95
74C73	.79
74C74	.79
74C85	1.95
74C86	.99
74C89	6.95
74C90	1.29
74C93	1.29
74C95	1.59
74C107	1.89
74C151	2.95
74C154	3.95
74C157	2.25
74C160	1.69
74C161	1.60
74C162	1.49
74C163	1.69
74C164	1.59
74C173	1.39
74C174	1.39
74C175	1.19
74C192	1.69
74C193	1.69
74C195	1.59
74C221	1.95
74C240	2.25
74C244	2.25
74C373	2.49
74C374	2.59
74C901	.69
74C903	.69
74C911	10.95
74C912	10.95
74C915	1.69
74C917	10.95
74C922	5.49
74C923	5.75
74C925	7.50
74C926	7.50
80C95	.79
80C97	.79

LINEAR

LH0002CN	6.85
LM10CLH	4.50
LM11CLH	4.75
LH0070-OH	4.95
TL071CP	.79
TL072CP	1.39
TL074CN	2.49
LH0082CD	35.80
TL082CP	1.19
TL084CN	2.19
LH0094CD	36.80
LM300H	.99
LM301CN	.35
LM302H	1.95
LM304H	1.95
LM305H	.99
LM307CN	.45
LM308CN	1.00
LM309H	1.95
LM309K	1.25
LM310CN	1.75
LM311/CN	.90
LM312H	2.49
LM317MP	1.15
LM317T	1.75
LM317K	3.95
LM318CN	1.95
LM319N	1.95
LM320K-5	1.35
LM320K-12	1.35
LM320K-15	1.35
LM320T-5	1.25
LM320T-12	1.25
LM320T-15	1.25
LM323K	5.95
LM324N	.99
LM329DZ	.65
LM331N	3.95
LM334Z	1.30
LM335Z	1.40
LM336Z	1.75
LM337T	1.95
LM337MP	1.15
LM338K	6.95
LM339N	.99
LM340K-5	1.35
LM340K-12	1.35
LM340K-15	1.35
LM340T-5	1.25
LM340T-12	1.25
LM340T-15	1.25
LM341P-5	.75
LM341P-12	.75
LM341P-15	.75
LM342P-5	.69
LM342P-12	.69
LM342P-15	.69
LM348N	1.25
LM350K	5.75
LF351N	.60
LF353N	1.00
LF355N	1.10
LF356N	1.10
LM358N	1.00
LM359N	1.79
LM370N	4.49
LM373N	3.25
LM377N	2.95
LM380N	1.25
LM381N	1.95
LM382N	1.79
LM384N	1.95
LM386N-3	1.29
LM387N	1.45
LM389N	1.35
LM392N	.69
LF398N	4.00
LM399H	5.00
TL494CN	4.49
TL496CP	1.75
NE510A	6.00
NE529A	4.95
NE531H	3.95
NE536H	6.00
NE540H	6.00
NE544N	4.95
NE550A	1.30
NE555V	.39
LM556N	.99
NE564N	3.95
LM565N	1.25
LM566CN	1.95
LM567V	1.25
NE570N	4.95
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LM703CN	.89
LM709N	.29
LM710N	.79
LM711N	.79
LM723N	.69
LM733N	1.00
LM739N	1.19
LM741CN	.35
MC1741SCG	3.00
LM747N	.79
LM748N	.59
LM1014N	2.75
LM1310N	1.95
LM1458CN	.59
LM1488N	1.25
LM1489N	1.25
LM1496N	1.95
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LM1871N	5.49
LM1872N	5.49
LM1877N-9	3.25
LM1889N	3.20
LM1896N	1.75
LM2002T	1.49
LM2877P	2.05
LM2878P	2.25
LM2896P-1	2.25
LM3189N	2.95
LM3900N	.69
LM3905CN	1.25
LM3909N	1.15
LM3914N	3.95
LM3915N	3.95
LM3916N	3.95
RC4136N	1.25
RC4151NB	3.95
RC4194TK	6.95
RC4195TK	5.49
LM4500A	3.25
ICL8038B	4.95
LM13080N	1.29
LM13600N	1.49
75138N	1.95
75450N	.89
75451CN	.39
75492	.89

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

Value	1-9	10-99	100+
10 pf	.08	.06	.05
22 pf	.08	.06	.05
47 pf	.08	.06	.05
100 pf	.08	.06	.05
220 pf	.08	.06	.05
470 pf	.08	.06	.05
.001µF	.08	.06	.05
.0047µF	.08	.06	.05
.01µF	.08	.06	.05
.022µF	.09	.07	.06
.047µF	.09	.07	.06
.1µF	.15	.12	.10

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07
.0022mf	.12	.10	.07
.0047mf	.12	.10	.07
,01mf	.12	.10	.07
.022mf	.13	.11	.08
.047mf	.21	.17	.13
.1mf	.27	.23	.17
.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (Solid) CAPACITORS

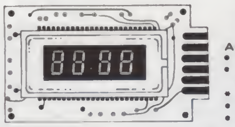
.1/35V	.39	.34	.29
.15/35V	.39	.34	.29
.22/35V	.39	.34	.29
.33/35V	.39	.34	.29
.47/35V	.39	.34	.29
.68/35V	.39	.34	.29
1.0/35V	.39	.34	.29
1.5/35V	.41	.37	.29
2.2/35V	.51	.45	.34
3.3/25V	.53	.47	.37
4.7/25V	.63	.56	.45
6.8/25V	.79	.69	.55
15/25V	1.39	1.25	.95
22/6V	.79	.69	.55

MINI. ALUMINUM ELECTROLYTIC CAPACITORS

Axial	1-99	100-499	500+
.47/50V	.16	.14	.10
1.0/50V	.19	.16	.12
3.3/50V	.17	.15	.11
4.7/25V	.18	.15	.11
10/25V	.18	.15	.11
10/50V	.19	.16	.12
22/25V	.19	.16	.12
22/50V	.24	.20	.18
47/25V	.25	.21	.19
47/50V	.29	.25	.23
100/25V	.28	.24	.22
100/50V	.41	.37	.34
220/25V	.39	.34	.33
220/50V	.49	.45	.41
470/25V	.54	.49	.45
1000/16V	.79	.69	.61
2200/16V	.89	.79	.69

Radial	1-99	100-499	500+
.47/25V	.15	.13	.12
.47/50V	.16	.14	.13
1.0/16V	.15	.13	.12
1.0/25V	.16	.14	.13
1.0/50V	.17	.15	.14
4.7/16V	.15	.13	.12
4.7/25V	.16	.14	.13
4.7/50V	.17	.15	.14
10/16V	.15	.13	.12
10/25V	.16	.14	.13
10/50V	.17	.15	.14
47/50V	.25	.21	.19
100/16V	.21	.17	.14
100/25V	.25	.23	.21
100/50V	.37	.34	.31
220/16V	.25	.21	.19
470/25V	.35	.31	.27

National Semiconductor Clock Modules



12VDC
AUTOMOTIVE/
INSTRUMENT
CLOCK

APPLICATIONS:
- In-dash autoclocks
- After-market auto/RV clocks
- Aircraft-marine clks.
- 12VDC oper. Instru.
- Portable/battery powered inatrumnts.

Features: Bright 0.3" green display. Internal crystal timebase. ± 0.5 sec./day accur. Auto. display brightness control logic. Display color filterable to blue, blue-green, green & yellow. Complete—just add switches and lens.

MA1003 Module (3.05"L×1.75"H×.98"D) . **$16.95**

CLOCK MODULES

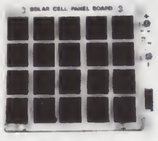
MA1023	.7" Red Digital LED Clock Module	8.95
MA1026	.7" Dig. LED Alarm Clock/Thermometer	18.95
MA5036	.3" Red Digital LED Clock/Timer	6.95
MA1002	.5" Red Digital LED Clock & Xformer	9.95
MA1010	.8" Red Digital LED Clock	7.95
MA1032	CBA .5" Digital LCD Clock	17.95
MA1043	.7" Green Digital LED Clock	8.95

TRANSFORMERS

102-P20	Xformer for MA1023, 1043 & 5036 Mods.	3.49
102-P22	Xformer for MA1026 Clock Modules	3.49
102-P24	Xformer for MA1010 Clock Modules	3.49

NEW!

Sun Power Your Electronics!
SOLAR CELL PANEL KIT



Features:
- Output: 10VDC, to 100mA in Series 5VDC, to 200mA in Parallel
- Panel may be easily connected for Series or Parallel out
- Over 11 square inches of active cell surface
- Voltage line tap @ 0.5V increments
- Provision for charging batteries
- Overall panel size: 4¾"L x 4½"H x ½"D

The JE305 Solar Cell Panel Kit contains 20 each solar cells. On the panel board are power line taps which allow the user to select voltages (one voltage at a time) from 0.5VDC to 10VDC. The applications of each panel can be further expanded by coupling additional panels in series for more voltage or in parallel for more current. The premium grade solar cells provide the current necessary for the operation of most portable transistor radios, small battery powered cassette tape players and unlimited experimental solar projects.

JE305 . . . . $39.95

EPROM Erasing Lamp

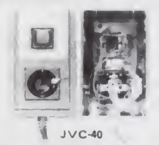
- Erases 2708, 2716, 1702A, 5203Q, 5204Q, etc.
- Erases up to 4 chips within 20 minutes.
- Maintains constant exposure distance of one inch.
- Special conductive foam liner eliminates static build-up.
- Built-in safety lock to prevent UV exposure.
- Compact — only 7-5/8" x 2-7/8" x 2"
- Complete with holding tray for 4 chips.

UVS-11EL Replacement Bulb $16.95

UVS-11E $79.95

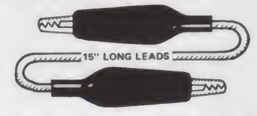
JOYSTICKS

JS-5K


JVC-40

JS-5K	5K Linear Taper Pots	$5.25
JS-100K	100K Linear Taper Pots	$4.95
JVC-40	40K (2) Video Controller in case	$4.95

ALLIGATOR CLIP TEST LEADS



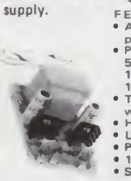
Heavy-duty leads, color coded. Insulated alligator clip on each end. 15" long. Two each black, red, blue, white and yellow

#ALCP (10 per pack) . . . . **$2.95/pkg.**

NEW!

JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.



FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC.
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling
- LED "on" indicator
- Printed Board Construction
- 120VAC input
- Size: 3-1/2"w x 5-1/16"L x 2"H

JE215 Adj. Dual Power Supply Kit (as shown) . . $24.95

(Picture not shown but similar in construction to above)

JE200 Reg. Power Supply Kit (5VDC, 1 amp)	$14.95
JE205 Adapter Brd. (to JE200) ±5, ±9 & ±12V.	$12.95
JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp.	$19.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES

INS8080A	CPU	4.95
DP8212	8-Bit Input/Output	3.25
DP8214	Priority Interrupt Control	5.95
DP8216	Bi-Directional Bus Driver	3.49
DP8224	Clock Generator/Driver	3.95
DP8226	Bus Driver	3.49
DP8228	System Controller/Bus Driver	4.95
DP8238	System Controller	5.95
INS8243	I/O Expander for 48 Series	9.95
INS8250	Asynchronous Comm. Element	16.95
DP8251	Prog. Comm. I/O (USART)	6.95
DP8253	Prog. Interval Timer	8.95
DP8255	Prog. Peripheral I/O (PPI)	5.95
DP8257	Prog. DMA Control	9.95
DP8259	Prog. Interrupt Control	9.95
DP8275	Prog. CRT Controller	39.95
DP8279	Prog. Keyboard/Display Interface	9.95
DP8303	System Timing Element	6.95
DP8304	8-Bit Bi-Directional Receiver	3.95
DP8307	8-Bit Bi-Directional Racalver	3.95
DP8308	8-Bit Bi-Diractional Racelver	3.95
DP8310	Octal Latched Peripheral Driver	5.25
DP8311	Octal Latchad Peripheral Driver	5.25

6800/6800 SUPPORT DEVICES

MC6800	MPU	7.95
MC6802CP	MPU with Clock and RAM	14.95
MC6810API	128x8 Static RAM	4.95
MC6821	Peripheral Inter. Adapt (MC6820)	7.49
MC6828	Priority Intarrupt Controller	17.95
MC6830L8	1024x8-Bit ROM (MC68A30-8)	14.95
MC6850	Asynchronous Comm. Adapter	6.95
MC6852	Synchronous Serial Data Adapter	6.95
MC6860	0-600bps Digital MODEM	10.95
MC6862	2400bps Modulator	12.95
MC6880A	Quad 3-State Bus. Trans. (MC8T26)	2.25

MICROPROCESSOR CHIPS

Z80 (780C)	CPU (MK3880N) (2MHz)	11.95
Z80A (780-1)	CPU (MK3880N-4) (4MHz)	13.95
CDP1802	CPU	19.95
2650	MPU	16.95
IDM2901ADC	CPU—4-Bit Slica (Com. Temp. Grade)	19.95
MCS6502	MPU w/Clock (65K Bytes Mamory)	11.95
INS8035N-6	MPU—8-Bit (6MHz)	7.95
INS8039N-6	CPU—Sgl. Chip 8-Bit (128bytes RAM)	9.95
INS8040N-6	CPU (256 Bytes RAM)	24.95
INS8070N	CPU—64 Bytes RAM	24.95
INS8073N	CPU w/Basic Micro Interprelar	29.95
P8085	CPU	9.95
TMS9900JL	MPU—16-Bit	39.95

SHIFT REGISTERS

MM500H	Dual 25-Bit Dynamic	.50
MM503H	Dual 50-Bit Dynamic	.50
MM506H	Dual 100-Bit Static	.50
MM510H	Dual 64-Bit Accumulator	.50
MM1402N	256-Bit Dynamic	2.95
MM5013N	1024-Bit Dynamic/Accumulator	1.95
MM5016H	500/512-Bit Dynamic	1.95
MM5034N	Octal 80-Bit	9.95
MM5035N	Octal 80-Bit	9.95
2504V(1404A)	1024-Bit Dynamic	1.95
2518N	Hax 32-Bit Static	3.95
2522V	Dual 132-Bit Static	2.95
2524V	512-Bit Dynamic	.99
2525V	1024-Bit Dynamic	2.95
2527V	Dual 256-Bit Static	2.95
2528V	Dual 250-Bit Static	4.00
2529V	Dual 240-Bit Static	4.00
2532N	Quad 80-Bit Static	2.95
3341PC	Fifo (Dual 80)	6.95

DATA ACQUISITION

AF100-1CN	Universal Active Filtar 2.5%	5.95
AF121-1CJ	Touch Tone Low Band Filter	19.95
AF122-1CJ	Touch Tona High Band Filtar	19.95
LM308CH	Super Gain Op Amp	1.15
LM334Z	Constant Current Sourca	1.30
LM335Z	Tamperature Transducer	1.40
LF356N	JFET Input Op Amp	1.10
LF398N	Sampla & Hold Amplifiars	3.95
LM399H	Temp. Comp. Prac. Ref. (.5ppm/C°)	5.00
ADC0804LCN	8-Bit A/D Convartar (1 LSB)	4.95
DAC0806LCN	8-Bit D/A Convartar (0.78% Lin.)	2.25

DATA ACQUISITION (CONTINUED)

ADC0809CCN	8-Bit A/D Converter (8-Ch. Multi.)	5.25
ADC0817CCN	8-Bit A/D Converter (16-Ch. Multi.)	10.95
DAC1000LCN	10-Bit D/A Conv. Micro. Comp. (0.05%)	13.95
DAC1008LCN	10-Bit D/A Conv. Micro. Comp. (0.20%)	8.95
DAC1020LCN	10-Bit D/A Converter (0.05% Lin.)	8.49
DAC1022LCN	10-Bit D/A Converter (0.20% Lin.)	5.95
DAC1222LCN	12-Bit D/A Converter (0.20% Lin.)	9.95
CD4051N	8-Channel Multiplexer	1.19
AY-5-1013	30K BAUD UART	6.95

RAM'S

1101	256x1 Static	1.49
1103	1024x1 Dynamic	.99
2101 (8101)	256x4 Static	3.95
2102	1024x1 Static	1.75
21L02	1024x1 Static	1.95
2111 (8111)	256x4 Static	3.95
2112	256x4 Static MOS	4.95
2114	1024x4 Static 450ns	3.25
2114L	1024x4 Static 450ns Low Power	3.49
2114-2	1024x4 Static 200ns	3.95
2114L-2	1024x4 Static 200ns Low Power	4.95
74S200	256x1 Static	6.95
4116N-4 (UPD416)	16K Dynamic 250ns (MM5290N-4)	2.95
4164N-3	64K Dynamic 200ns	19.95
MM2147J	4096x1 Fast 70ns	7.95
5101	256x4 Static	7.95
MM5261	1024x1 Dynamic Fully Decodad	.99
MM5262	2Kx1 Dynamic	.49
MM5280/2107	4096x1 Dynamic	4.95
MM5290N-2 (4116)	16K Dynamic 150ns (UPD416C-3)	3.95
MM5298J-3A	8K Dyn. 200ns (lower ½ of MM5290J)	1.95
HM6116-4	16K (2Kx8) Static 200ns	14.95
82S25	64 Bit RAM (16x4OC)	3.49
UPD414/MK4027	4K Dynamic 16-pin	4.95
TMS4044-45NL	4K Static	9.95
TMS4045	1024x4 Static	9.95

PROMS/EPROMS

1702A	2K UV Erasable PROM	5.95
2708	8K EPROM	4.95
TMS2716	16K EPROM (-5V, +5V, +12V)	9.95
2716Intel(2516)TI	16K EPROM (Single +5V)	8.95
2732Intel TI	32K EPROM	17.95
2758	8K EPROM (450ns) (Single +5V)	7.49
2764Q	64K EPROM (Hitachi HN462764)	49.95
5203	2048 PROM	14.95
82S23(74S188)	32x8 PROM (Open Collactor)	3.95
82S115	4096 Bipolar PROM	14.95
82S123(74S288)	32x8 Tri-Stata Bipolar PROM	3.95
82S185	8K PROM	16.95

— Over 30 Mora PROMS Listed in Our Catalog —

ROM'S

2513(2140)	Character Ganarator (Uppar Casa)	9.95
2513(3021)	Charactar Ganarator (Lowar Case)	9.95

NMOS READ ONLY MEMORIES

MCM66710P	128x9x7 ASCII Shiftad w/Greak	13.50
MCM66740P	128x9x7 Math Symbol & Picturas	13.50
MCM66750P	128x9x7 Alpha. Control Char. Gan.	13.50

MICROPROCESSOR MANUALS

M-Z80	User Manual	7.50
M-CDP1802	User Manual	7.50
M-2650	User Manual	5.00

SPECIAL FUNCTION

DS0025CN	Dual MOS Clock Driver (5MZ)	3.50
DS0026CN	Dual MOS Clock Driver (5MZ)	1.95
INS1771N-1	Floppy Disc Controllar	24.95
INS2651N	Communication Chip	19.95
MM58167N	Microprocessor Raal Tima Clock	8.95
MM58174N	Microprocassor Compatibla Clock	11.95
COP402N	Microcontroller with 64-Digit RAM and Diract LED Driva	6.95
CDP402MN	Microcontroller with 64-Digit RAM & Direct LED Drive w/N Buss Int.	7.49
COP470N	32-Seg. VAC Fluor. Driver (20-pin pkg.)	3.25

TELEPHONE/KEYBOARD CHIPS

AY-5-9100	Push Button Telephone Dialer	14.95
AY-5-9200	Repertory Dialer	14.95
AY-5-9500	CMOS Clock Generator	4.95
AY-5-2376	Keyboard Encodar (88 keys)	11.95
HD0165-5	Keyboard Encodar (16 keys)	7.95
74C922	Keyboard Encodar (16 kays)	5.49
74C923	Keyboard Encoder (20 kays)	5.75
MM53190N	Push Button Pulse Dialar	7.95
MM57499N	96/144-Key Serial Keyboard Encoder	8.95

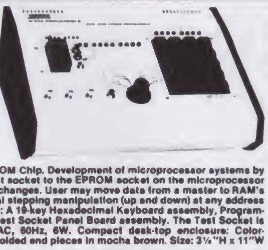
RADIO CONTROL CIRCUITS

Ideal for remote control systems which use pulse amplitude modulation (toy cars, boats, tanks, etc.). Features: five function control, adjustable steering angle, suitable for 27 and 47MHz bands and low power consumption.

KB-4428 TRANSMITTER $4.25
Abs. max. rating (TA@25°C). Supply volt.: Vcc1 12VDC. Power Dissipation: PD: 300mW; Temp. range: Oper. 0— + 50°C — Storage -30— + 125°C. Recommended oper. volt.: 7-11V. Crystal or CR Oscillation circuits acceptable.

KB-4429 RECEIVER $5.95
Abs. max. rating (TA@25°C). Supply volt.: Vcc1: 11V. Vcc2: 7.5V. Power Dissipation: 600W. Temp. range: Oper. 0 ± 50°C. Recommended oper. volt.: VOP1 7-11V — VOP2 3-6V.

JE608 PROGRAMMER
2704/2708 EPROM PROGRAMMER



GENERAL APPLICATIONS:
- To program EPROMS 2704 and 2708.
- Developmental system for microcomputer circuits
- To read the contents of a pre-programmed EPROM
- To compare EPROM(s) for content differences
- To emulate a programmed EPROM
- To store program in RAMS for alterations
- Three separate Display Registers: 8 LED's for Hex Key entries, 10 LED's (2^0-2^9) for Address Register and 8 LED's for Data Memory Register. The Data Memory Register displays the content of the RAMs from the EPROM Chip. Development of microprocessor systems by means of a ribbon cable from the programmer panel test socket to the EPROM socket on the microprocessor board. Rapid checking verification of programmed data changes. User may move data from a master to RAM's or write into RAM's with keyboard entries. Allows manual stepping manipulation (up and down) at any address location. Stand-alone EPROM Programmer consisting of: A 19-key Hexadecimal Keyboard assembly, Programmer Board assembly with 4 power supplies and a LED/Test Socket Panel Board assembly. The Test Socket is zero force insertion type. Power requirements: 115VAC, 60Hz, 6W. Compact desk-top enclosure: Color-coordinated designer's case with light tan panels and molded end pieces in mocha brown. Size: 3¼"H x 11"W x 8¾"D. Weight: 5 lbs.

The JE608 EPROM Programmer is a completely self-contained unit which is independent of computer control and requires no additional systems for its operations. The EPROM can be programmed from the Hexadecimal Keyboard or from a pre-programmed EPROM. The JE608 Programmer can emulate a programmed EPROM by the use of its internal RAM circuits. This will allow the user to test or pretest a program for a system, prior to programming a chip. Any changes in the program can be entered directly into the memory circuits with the Hexadecimal Keyboard so that rewriting the entire program will not be necessary. The JE608 Programmer contains a Programmer/Board w/25 IC's & includes power supplies of: -5V, +5V, +12V and +26V. The Hexadecimal Keyboard and LED/Test Socket Panel board are separate assemblies within the system.

JE608K Kit $399.95
JE608A Assembled and Tested $499.95

JE608-16K ADAPTER BOARD
FOR 2716/2758 EPROMS

GENERAL DESCRIPTION:
The JE608-16K Adapter Board allows the JE608 Programmer to be modified for the additional programming of the 2716 and 2758 EPROMS. The adapter provides for adding an address switch for the 2^{11} bit and also for selecting the proper power and timing pulses to be applied to the EPROM. Programming and emulating the 2716 (16K) EPROM is done separately to each half (1024x8) of the EPROM because of the existing 8K RAM capacity in the JE608 Programmer.

JE608-16K	Adapter Board Kit	$29.95
JE608-Upgrade	(Send assembled JE608 to factory for adapter installation of the JE608-16K Adapter Board Kit)	$99.95
JE608A-16K Mod.	Assembled JE608 w/Adapter (JE608-16K) Installed	$599.95

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BOOKS
National Semiconductor — Intersil — Intel

30001	**National CMOS Data Book** (640 pages) 74C, CD4000, and A/D Converters	$5.95
30002	**National Interface Data Book** (704 pages) DP, DS8000, DS3600, DS75000, etc.	$5.95
30003	**National Linear Data Book** (1376 pages) LM, LF, ADC, DAC, LH Series	$8.95
30004	**National Series 80 — Board Level Computer** (224 pages)	$4.95
30005	**National TTL Logic Data Book** (624 pages) 7400, LS, L, H, S, and DM8000 Series	$8.95
30006	**Buy above (3) 30001,3,5 as a set**	$19.95/lot
30009	**Intersil Data Book** (1074 pages)	$6.95
010400	**Intel Component Data Catalog** Full data sheets for Intel's products incl. memory devices, microproc., peripherals & indust./mil. products (1328 pages)	$10.00
205610	**Intel Peripheral Design Handbook** Full data sheets, appl. notes for Intel peripheral device components (644 pages)	$7.50

AC and DC Wall Transformers

Ideal for use with clocks, games, power supplies or any other type of AC or DC application.

Part No.	Input	Output	Price
AC 250	117V/60Hz	12 VAC 250mA	$3.95
AC 500	117V/60Hz	12 VAC 500mA	$4.95
AC1000	117V/60Hz	12 VAC 1 amp	$5.95
AC1700	117V/60Hz	9 VAC 1.7 amp	$3.95
DV 9200	117V/60Hz	9 VDC 200mA	$3.25
DC 900	120V/60Hz	9 VDC 500mA	$3.95

CONNECTORS

DB25P	D-Subminiature Plug	$2.95
DB25S	D-Subminiature Socket	$3.50
D20418-2	Screw Lock Hdwr. (2) DB25S/P	2/$.99
DB51226	Cover for DB25P/S	$1.75
22/44SE	P.C. Edge (22/44 Pin)	$2.95
UG88/U	BNC Plug	$1.79
UG89/U	BNC Jack	$3.79
UG175/U	UHF Adapter	$ .49
SO239	UHF Panel Recp.	$1.29
PL258	UHF Adapter	$1.60
PL259	UHF Plug	$1.60
UG260/U	BNC Plug	$1.79
UG1094/U	BNC Bulkhead Recp.	$1.29

TRS-80
16K Conversion Kit

Expand your 4K TRS-80 System to 16K.
Kit comes complete with:
★ 8 ea. MM5290 (UPD416/4116) 16K Dyn. Rams (*NS)
★ Documentation for Conversion

TRS-16K2	*150NS	$29.95
TRS-16K3	*200NS	$24.95
TRS-16K4	*250NS	$19.95

JE610 ASCII Encoded Keyboard Kit

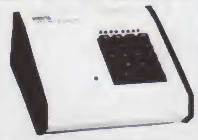
The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with an industrial grade keyboard switch assembly (62-keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and −12V @ 10 mA for operation. Features: 60 keys generate the 126 characters, upper and lower case ASCII set. Fully buffered. Two user-define keys provided for custom applications. Caps lock for upper-case-only alpha characters. Utilizes a 2376 (40-pin) encoder read-only memory chip. Outputs directly compatible with TTL/DTL or MOS logic arrays. Easy interfacing with a 16-pin dip or 18-pin edge connector. Size: 3½"H x 14½"W x 8¾"D

JE610/DTE-AK	(After assembled as pictured above)	**$124.95**
JE610 Kit	62-Key Keyboard, PC Board, & Components (no case).	**$ 79.95**
K62	62-Key Keyboard (Keyboard only)	**$ 34.95**
DTE-AK	(case only — 3¼"Hx11"Wx8¾"D)	**$ 49.95**

NEW! JE212 — Negative 12VDC Adapter Board Kit for JE610 ASCII KEYBOARD KIT
Provides -12VDC from incoming 5VDC . . $9.95

JE600
Hexadecimal Encoder Kit

FULL 8-BIT
LATCHED OUTPUT
19-KEY KEYBOARD



The JE600 Encoder Kayboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry strobe. Features: Full 8-bit latched output for microprocessor use. Three user-define keys with one being bistable operation. Debounce circuit provided for all 19 keys. 9 LED readouts to verify entries. Easy interfacing with standard 16-pin IC connector. Only +5VDC required for operation. Size: 3½"H x 8¼"W x 8¾"D

JE600/DTE-HK	(After assembled as pictured above)	**$99.95**
JE600 Kit	19-Key Hexadec. Keyboard, PC Board & Cmpnts. (no case)	**$59.95**
K19	19-Key Keyboard (Keyboard only)	**$14.95**
DTE-HK	(case only — 3½"Hx8¼"Wx8¾"D)	**$44.95**

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PCBD .... $56.95 KIT $175.00

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PCBD .... $33.95 KIT (LESS ROMS) $74.95

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PCBD .... $33.95 KIT $124.95

* **QMB-12** 13 SLOT MOTHER BOARD.
PCBD .... $42.95 KIT $125.95

* **QMB-9** 9 SLOT MOTHER BOARD.
PCBD .... $35.95 KIT $109.95

* **PTB-1** POWER SUPPLY AND TERMINATOR BOARD.
PCBD .... $29.95 KIT $49.95

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PCBD .... $29.95 KIT $79.95

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CPU-1 8080 PROCESSOR, PCBD. $29.95
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7400N	19
7402N	20
7404N	25
7409N	27
7410N	25
7414N	70
7420N	25
7422N	39
7430N	25
7442N	58
7445N	82
7447N	63
7448N	77
7450N	25
7474N	35
7475N	49
7485N	88
7489N	1 70
7490N	43
7492N	43
7493N	43
7495N	89
74100N	1 35
74107N	35
74121N	34
74123N	59
74125N	45
74145N	77
74150N	1 20
74151N	69
74154N	1 25
74157N	69
74181N	87
74162N	85
74163N	87
74174N	96
74175N	85
74190N	1 15
74192N	87
74193N	85
74221N	1 25
74298N	1 65
74365N	75
74366N	75
74367N	75

74LS00 TTL

74LS00N	29
74LS02N	29
74LS04N	35
74LS05N	25
74LS08N	35
74LS10N	35
74LS13N	55
74LS14N	1 00
74LS20N	35
74LS22N	35
74LS28N	35
74LS30N	35
74LS33N	60
74LS38N	50
74LS74N	45
74LS75N	65
74LS90N	60
74LS93N	75
74LS95N	1 00
74LS107N	45
74LS112N	45
74LS113N	45
74LS132N	89
74LS136N	50
74LS151N	75
74LS155N	79
74LS157N	1 10
74LS162N	1 10
74LS163N	1 10
74LS174N	1 15
74LS190N	1 25
74LS221N	1 25
74LS258N	1 00
74LS367N	89

LINEAR

CA3045	90
CA3046	1 10
CA3081	1 80
CA3082	1 90
CA3089	3 40
LM301AN/AH	35
LM305H	87
LM307N	35
LM308N	1 00
LM309K	1 25
LM311H/N	90
LM317T	1 65
LM317K	3 75
LM318	1 50
LM320K-5	1 35
LM320K-12	1 35
LM320K-15	1 35
LM320T-5	95
LM320T-8	95
LM320T-12	95
LM320T-15	95
LM323K-5	5 95
LM324N	1 00
LM339N	1 00
LM340K-5	1 35
LM340K-8	1 35
LM340K-12	1 35
LM340K-15	1 35
LM340K-24	1 35
LM340T-5	85
LM340T-8	85
LM340T-12	85
LM340T-15	85
LM340T-18	85
LM340T-24	85
LM350	5 50
LM377	2 95
LM379	5 00
LM380N	1 00
LM381	1 60
LM382	1 60
LM709H	59
LM723H/N	50
LM733N	85
LM741CH	35
LM741N	38
LM747H/N	75
LM748N	50
LM1303N	1.75
LM1304	1 10
LM1305	1 27
LM1307	2 00
LM1310	2 75
LM1458	55
LM1812	7 50
LM1889	3 00
LM2111	1 75
LM2902	2 25
LM3900N	60
LM3905	1 75
LM3909N	95
MC1458V	55
NE550N	1 35
NE555V	39
NE556A	85
NE565A	1 00
NE566V	1 50
NE567V	1 00
NE570B	4 75
78L05	60
78L08	60
78M05	85
75108	1 75
75491CN	50
75492CN	55
75494CN	89

A to D CONVERTER

80388	4 50
8700CJ	13 95
8701CN	22 00
8750CJ	13 95
LD130	9 95
9400CJV/F	7 40
ICL7103	9 50
ICL7107	14 25

CMOS

CD4000	25
CD4001	35
CD4002	35
CD4006	1 10
CD4007	35
CD4008	1 20
CD4009	45
CD4010	45
CD4011	35
CD4012	28
CD4013	47
CD4014	1 25
CD4015	1 00
CD4018	55
CD4017	1 05
CD4018	94
CD4019	45
CD4020	1 02
CD4021	1 35
CD4022	1 10
CD4023	28
CD4024	75
CD4025	28
CD4026	2 50
CD4027	66
CD4028	85
CD4029	1 35
CD4030	45
CD4035	1 00
CD4040	1 35
CD4042	85
CD4043	85
CD4044	85
CD4048	1 67
CD4049	45
CD4050	60
CD4051	1 13
CD4060	1 42
CD4066	71
CD4068	40
CD4069	40
CD4070	50
CD4071	45
CD4072	45
CD4073	45
CD4075	45
CD4078	1 45
CD4078	40
CD4081	35
CD4082	35
CD4118	47
CD4490	5 50
CD4507	1 00
CD4508	2 85
CD4510	1 00
CD4511	94
CD4515	2 52
CD4516	1 10
CD4518	1 50
CD4520	1 02
CD4527	1 51
CD4528	1 60
CD4553	3 50
CD4566	2 45
CD4583	2 35
CD4585	1 10
CD40192	3 00
74C00	35
74C04	40
74C10	35
74C14	89
74C20	35
74C30	35
74C48	1 95
74C74	85
74C76	1 25
74C90	1 25
74C93	1 25
74C154	3 50
74C160	2 75
74C175	1 35
74C192	1 65
74C221	1 90
74C905	6 00
74C906	75
74C914	1 95
74C922	5 00
74C923	5 50
74C925	7 50
74C926	6 95
74C927	6 95

INTERFACE

8095	85
8096	65
8097	65
8098	65
8T09	1 25
8T10	4 50
8T13	3 00
8T20	5 50
8T23	3 10
8T24	3 50
8T25	3 20
8T28	1 89
8T28	2 75
8T97	1 69
8T98	1 89

MOS/MEMORY
RAM

2101-1	2 95
2102-1	95
2102AL-4	1 45
2102AN-2L	1 85
2104A-4	4 95
2107B-4	3 75
2111-1	3 75
2112-2	3 95
2114	3 75
2114L 300ns	4 25
2114L 450ns	4 00
4116 200ns	2 95
8/4116 200ns	18 40
MM5262	40
MM5280	3 00
MM5320	9 95
MM5330	5 94
PD411D-3	4 00
PD411D-4	5 00
P5101L	8 95
4200A	9 95
82S25	2 90
91L02A	1 50
HD0165-5	6 95
MM57100	4 50
GIAY38500-1	9 95
MCM66751A	9 95
9368	3 50
410D	10 00
418	18 00

CLOCKS

MM5311	5 50
MM5312	3 90
MM5314	3 90
MM5369	2 10
MM5841	14 45
MM5865	7 95
CT7010	8 95
CT7015	8 95
MM5375AA/N	3 90
MM5375AG/N	4 90
7205	16 50
7207	7 50
7208	15 95
7209	4 95
DS0028CN	3 75
DS0056CN	3 75
MM53104	2 50

MICROPROCESSOR

6502	10 95
6504	9 95
6522	9 95
6530	9 50
6800	6 95
6802	11 95
6820	4 95
6850	5 95
8080A	3 95
8085	12 95
Z80	9 95
Z80A	11 95
8212	2 90
8214	3 95
8218	2 90
8224	3 45
8228	4 95
8251	8 95
8253	15 00
8255	5 75
8257	10 95
8259	14 95
1802CP plas	13 95
1802DP plas	17 95
1861P	9 50
CDP1802CD	28 95
CDP1802D	35 00
CDP1816P	7 95

UART/FIFO

AY5-1013	5 50
AY5-1014	7 50
3341	6 95

PROM

1702A	4 50
2532	19 75
2708	4 70
2718T1	8 50
2716 5 Volt	6 50
8/2716 5 Volt	48 00
2732	19 75
2758	14 00
8741A	55 00
8748	55 00
8748-8	55 00
8755A	55 00
N82S23	2 95
N82S123	4 95
N82S126	4 75
N82S129	4 95
N82S131	4 95
N82S138	8 75
N82S137	8 75
DM8577	2 90
8223	3 50

CONNECTORS

30 pin edge	2 50
44 pin edge	2 75
86 pin edge	4 00
100 pin edge	4 50
100 pin edge WW	5 25

IC SOCKETS
Solder Tin Low Profile

PIN	1UP	PIN	1UP
8	15	22	30
14	14	24	35
16	16	28	42
18	27	36	58
20	.29	40	57

2 level 14 pin ww 20

WIRE WRAP LEVEL 3

PIN		PIN	
14	55	24	.93
18	57	28	1 00
18	67	40	1.59

CRYSTALS

1 MHz	4 50
2 MHz	4 50
4 MHz	4 25
5 MHz	4 25
10 MHz	4 25
18 MHz	3 90
20 MHz	3 90
32 MHz	3 90
32768 Hz	4 00
1 8432 MHz	4 50
3 5795 MHz	1 20
2 0100 MHz	1 95
2 097152 MHz	4 50
2 4576 MHz	4 50
3 2768 MHz	4 50
5 0688 MHz	4 50
5 185 MHz	4 50
5 7143 MHz	4 50
6 5536 MHz	4 50
14 31818 MHz	4 25
18 432 MHz	4 50
22 1184 MHz	4 50

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AY5-2378	$12 50
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Metal Enclosure	29 95

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Green, Yellow T018	20
Jumbo Red	20
Green, Orange, Yellow Jumbo	25
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12 6 CT 2 amp	5 95
12 6 CT 4 amp	9 45
12 6 CT 8 amp	12 45
12 6V CT 600 ma	3 75
12V 250 ma wall plug	2 95
12V CT 250 ma wall plug	3 75
24V CT 100 ma	3 95
10V 1 2 amp wall plug	4 85
12V 8 amp	12 95
12V 500 ma wall plug	4 75
12V 1 amp wall plug	8 50
10.15 VAC 8 18 VA wall plug	9 75

DISPLAY LEDS

MAN1	CA	270	2 90
MAN3	CC	125	39
MAN72/74	CA/CA	300	1 00
DL704	CC	300	1 25
DL707/DL707R	CA	300	1 00
DL727/728	CA/CC	500	1 90
DL747/750	CA/CC	600	1 95
FND359	CC	357	70
FND500/507	CC/CA	500	1 35
FND503/510	CC/CA	500	90
FND800/807	CC/CA	800	2 20
3 digit Bubble			80
10 digit display			1 25
7520 Clairex photocells			39
TIL311 Hex			9 50
MAN3640	CC	30	1 10
MAN4810	CA	40	1 20
MAN4640	CC	40	1 20
MAN4710	CA	40	95
MAN4740	CC	40	1 20
MAN6640	CC	56	2 95
MAN6710	CA	60	1 35
MAN6740	CC	60	1 35

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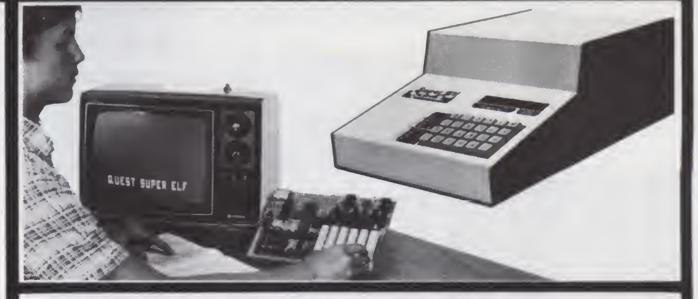

RCA Cosmac 1802 Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for 5 S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Free 14 page brochure.
of complete Super Elf system.

Moews Video Graphics **$3.50.** Games and Music **$3.00**, Chip 8 Interpreter **$5.50.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50.** A **50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply).

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range $\pm.17E^{38}$), 32 bit integer ±2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library.

Serial and Parallel I/O included.
Super Basic on Cassette $55.00.

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

Type-N-Talk by Votrax

Text to speech synthesizer with unlimited vocabulary, built-in text to speech algorithm, 70 to 100 bits per second speech synthesizer, RS232C interface $345.00.

1802 16K Dynamic RAM Kit $149.00

Expandable to 64K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$25.00**

Tiny Basic Extended on Cassette	**$15.00**
(Added commands include Stringy, Array, Cassette I/O etc.) S-100 4-slot expansion	**$ 9.95**
Super Monitor VI.I Source Listing	**$15.00**

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80 etc.
Dealers: Send for excellent pricing/margin program.

Editor Assembler	**$25.00**
(Requires minimum of 4K for E/A plus user source)	
1802 Tiny Basic Source listing	**$19.00**
Super Monitor V2.0/2.1 Source Listing	**$20.00**

PROM Eraser

assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$78.50** (with timer **$108.50**).

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00.** **Tiny Basic $30.00**

S-100 Computer Boards

8K Static Godbout Econo IIA Kit	149.00
16K Static Godbout Econo XIV Kit	269.00
24K Static Godbout Econo XX-24 Kit	414.00
32K Static Godbout Econo XX-32 Kit	537.00
16K Dynamic RAM Kit	289.00
32K Dynamic RAM Kit	328.00
64K Dynamic RAM Kit	399.00
Video Interface Kit	**$161.00**
Color Video Kit	129.95

81 IC Update Master Manual $79.95

Comp. IC data selector, 2 vol. master reference guide. Over 51,000 cross references. Free update service through 1981. Domestic postage $4.75.

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included. Bd. Only $17.00. Article in June *Radio Electronics*.

Gremlin Color Video Kit $69.95

32 x 16 alpha/numerics and graphics; up to 8 colors with 6847 chip; 1K RAM at E000. Plugs into Super *Elf 44 pin bus*. No high res. graphics. On board RF Modulator Kit **$4.95**

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$9.95**

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display, ROM monitor, fully expandable. **$405.00.** 4K version **$450.00.** 4K Assembler **$85.00**, 8K Basic Interpreter **$100.00**.

Special small power supply for AIM65 assem. in frame **$54.00.** Complete AIM65 in thin briefcase with power supply **$499.00.** Molded plastic enclosure to fit both AIM65 and power supply **$47.50.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$625.00.**

AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

Video Modulator Kit $9.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$35.95.** Kit with chassis and all hardware **$51.95.** Add $5.00 shipping. Kit of hardware **$16.00.** Woodgrain case **$10.00.** $1.50 shipping.

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax.
$10.00 min. BankAmericard and Master Charge accepted. $1.00 insurance optional.
Postage: Add 5%. C.O.D. $10.00 min. order.

FREE: Send for your copy of our NEW 1981 QUEST CATALOG. Include 48¢ stamp.

COMPONENTS

SN7400N	18	SN7482N	30
SN7402N	22	SN7492N	49
SN7404N	21	SN7493N	45
SN7408N	22	SN7495N	50
SN7410N	18	SN7496N	89
SN7412N	20	SN74122N	39
SN7413N	22	SN74136N	95
SN7414N	29	SN74141N	69
SN7416N	27	SN74151N	65
SN7417N	29	SN74153N	56
SN7420N	17	SN74154N	1 25
SN7425N	20	SN74155N	75
SN7430N	17	SN74157N	58
SN7437N	26	SN74160N	89
SN7438N	24	SN74161N	65
SN7440N	18	SN74163N	85
SN7442N	45	SN74164N	87
SN7443N	42	SN74165N	55
SN7445N	64	SN74174N	88
SN7451N	19	SN74175N	79
SN7454N	19	SN74180N	75
SN7474N	27	SN74181N	1 15
SN7475N	35	SN74393N	1 85

74LS00

74LS00	28	74LS158	89
74LS02	28	74LS161	83
74LS03	28	74LS162	89
74LS04	28	74LS163	98
74LS05	22	74LS164	65
74LS08	29	74LS165	66
74LS09	28	74LS169	1 56
74LS10	26	74LS170	1 75
74LS14	89	74LS174	66
74LS20	22	74LS175	85
74LS21	26	74LS190	85
74LS26	40	74LS191	1 25
74LS27	27	74LS195	96
74LS28	37	74LS197	78
74LS30	29	74LS221	1 25
74LS32	.31	74LS240	1 65
74LS38	31	74LS241	1 65
74LS42	63	74LS243	1 56
74LS48	77	74LS244	1 56
74LS74	38	74LS245	2 45
74LS75	55	74LS251	1 25
74LS86	45	74LS253	85
74LS90	59	74LS257	85
74LS93	65	74LS259	1 95
74LS96	80	74LS260	55
74LS107	43	74LS273	1 55
74LS113	45	74LS279	45
74LS122	45	74LS290	1 25
74LS123	89	74LS293	1 85
74LS125	89	74LS365	85
74LS126	79	74LS367	75
74LS138	64	74LS373	1 45
74LS139	59	74LS374	1 45
74LS151	49	74LS377	1 25
74LS153	49	74LS669	1 55
74LS157	89	74LS670	1 85

74S00

74S00	39	74S138	75
74S02	45	74S140	1 00
74S03	38	74S158	75
74S04	39	74S174	1 35
74S05	39	74S175	1 35
74S10	39	74S182	75
74S15	45	74S189	4 25
74S20	55	74S201	6 75
74S22	55	74S240	2 75
74S30	75	74S244	2 95
74S37	55	74S251	2 75
74S50	65	74S287	2 95
74S51	49	74S288	2 95
74S64	55	74S299	5 75
74S74	65	74S470	9 25
74S86	95	74S471	9 50
74S112	1 95	74S473	9 50
74S132	1 45	74S474	9 50

EPROMS

2708		3.25ea	8 for 2.95ea
2716		5.50ea	8 for 5.00ea
2732		12.95ea	4 for 11.00ea
4116	300NS	2.00ea	8 for 14.00
	200NS	2.35ea	8 for 16.00
2114L	300NS	2.25ea	4 for 1.90ea
	200NS	2.45ea	4 for 2.00ea
2111	450NS	2.50ea	10 for 2.00ea

MISC.

2102 450NS	.95
8038	2.95
NE555	.27
AY5-1013A	4.25
1488	.95
1489	.95
8T26	1.30
8T28	1.30
8212	1.95
8216	1.95
IS410SCR	.85
IT410TRIAC	.85
7905	.85
7906	.85
7915	.85
7918	.85
7805	.85
7806	.85
7808	.85
7812	.85
MC1330A1P	1.60
MC1350P	1.15
MC1358P	1.50
LM380	1.10
LM565N	.95
LM741	.25
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LM720	.30
LM386	1.30

cont'd

1103A	.75
UPD765 floppy disk controller	19.95 w/spe
ULN2001	1.95
TMS4400	1.40
MC4008P	1.50
MH0026	1.55
D3624	1.95
D3001	1.95
D3002	1.95

I.C. SOCKETS

ww	p	st
	8	10/1.20
10/5.30	14	10/1.30
10/5.70	16	10/1.40
10/8.70	18	10/1.60
10/9.70	20	10/2.70
10/12.70	22	10/2.70
10/13.70	24	10/2.70
10/14.70	28	10/3.00
10/17.70	40	10/3.90
wirewrap		solder

CPUs

Z-80	7.95
Z-80A CTC	10.50
Z-80A CPU	10 50
Z-80 002 16-64K	129.00
8085A	13.50
2901A	7.50
MC6800	9.50

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Video Monitor / Green !!
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8255 → $7.95
8748-8 → $31.00
3341PC → $2.00
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MC6800 → $7.75
MC6802 → $14.95
MC6850 → $4.50
MC6821 → $4.95

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MICROSOFT:
Z80 $295.00
16K RAM $160.00

VIDEX:
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KEYBOARD ENHANCER
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CALIF. COMP. SYS:
APPLE CLOCK
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PROTO BOARD
$25.00

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EPSON:
MX-80
ST: $535.00
FT: $645.00

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BEST SELLERS

BOOKS!

1981 IC MASTER 59.95
Sybex: "MICROPROCESSORS" 12.95
Osborne: "APPLE II USER'S GUIDE" 15.95

SPECIALS

3inch COMPUTER FANS w/cord → $9.95
2111 → 256×4 Static RAM → $1.75
8155 → RAM, I/O, Timer → $11.50
ER2051 → EAROM → $4.95
8085A → CPU → $8.50
MC6800 → CPU → $7.75
UPD 765A → Floppy Disk Controller → $19.95
2732A → 250ns EPROM → $15.50
AY5 1013A → 30K Band UART → $2.95
93419 → 64×9 Static RAM → $5.50
2901A → 4-Bit Slice → $7.50

4inch FAN
"Whisper"
w/cord
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REAL-TIME CLOCK CALENDAR (MSM 5832)

Description: Mono. Metal Gate CMOS I.C.

Features
- Time, Month, Date, Year, & Day of Week
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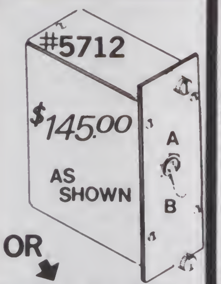

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RS 232 COMPATABLE DIGITAL TRANSFER SWITCH WILL SWITCH MODEMS BETWEEN PROCESSORS / PRINTERS 24 PINS ARE SWITCHED. PIN 1 WIRED TO GROUND

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NEW ATARI SOFTWARE

MISSLE COMMAND → $36.00
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48k — $1199.00
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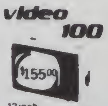
MONITORS

12 inch
12 MHz
BLACK & WHITE VIDEO MONITOR
AMDEK (LEEDEX) Corp.



12 inch
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GREEN Phos
VIDEO MONITOR

$365.00

TERMINALS

SOROC TECHNOLOGY INC

IQ120
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Synertek "KTM-3"
LOW COST TERMINAL WITH KEYBOARD AND VIDEO 100
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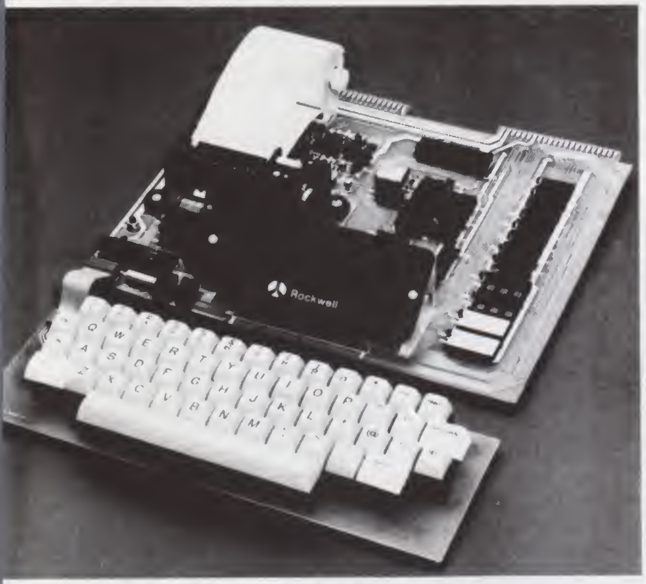
AIM 65 BY ROCKWELL INTERNATIONAL



I 65 is fully assembled, tested and warranted. With the lition of a low cost, readily available power supply, it's dy to start working for you.

IM 65 features on-board thermal printer and hanumeric display, and a terminal-style keyboard. It an addressing capability up to 65K bytes, and comes h a user-dedicated 1K or 4K RAM. Two installed 4K MS hold a powerful Advanced Interface Monitor gram, and three spare sockets are included to expand board ROM or PROM up to 20K bytes.

n Application Connector provides for attaching a TTY d one or two audio cassette recorders, and gives exter- access to the user-dedicated general purpose I/O lines.

lso included as standard are a comprehensive AIM 65 er's Manual, a handy pocket reference card, an R6500 rdware Manual, an R6500 Programming Manual and an I 65 schematic.

IM 65 is packaged on two compact modules. The cuit module is 12 inches wide and 10 inches long, the yboard module is 12 inches wide and 4 inches long. ey are connected by a detachable cable.

ERMAL PRINTER

st desired feature on low-cost microcomputer systems . . .

- Wide 20-column printout
- Versatile 5 x 7 dot matrix format
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- Fast 120 lines per minute
- Quite thermal operation
- Proven reliability

LL-SIZE ALPHANUMERIC KEYBOARD

ovides compatibility with system terminals . . .

- Standard 54 key, terminal-style layout
- 26 alphabetic characters
- 10 numeric characters
- 22 special characters
- 9 control functions
- 3 user-defined functions

UE ALPHANUMERIC DISPLAY

ovides legible and lengthy display . . .

- 20 characters wide
- 16-segment characters
- High contrast monolithic characters
- Complete 64-character ASCII alphanumeric format

PROVEN R6500 MICROCOMPUTER SYSTEM DEVICES

Reliable, high performance NMOS technology . . .

- R6502 Central Processing Unit (CPU), operating at 1 MHz. Has 65K address capability, 13 addressing modes and true index capability. Simple but powerful 56 instructions.
- Read/Write Memory, using R2114 Static RAM devices. Available in 1K byte and 4K byte versions.
- 8K Monitor Program Memory, using R2332 Static ROM devices. Has sockets to accept additional 2332 ROM or 2532 PROM devices, to expand on-board Program memory up to 20K bytes.
- R6532 RAM-Input/Output-Timer (RIOT) combination device. Multipurpose circuit for AIM 65 Monitor functions.
- Two R6522 Versatile Interface Adapter (VIA) devices, which support AIM 65 and user functions. Each VIA has two parallel and one serial 8-bit, bidirectional I/O ports, two 2-bit peripheral handshake control lines and two fully-programmable 16-bit interval timer/event counters.

BUILT-IN EXPANSION CAPABILITY

- 44-Pin Application Connector for peripheral add-ons
- 44-Pin Expansion Connector has full system bus
- Both connectors are KIM-1 compatible

TTY AND AUDIO CASSETTE INTERFACES

Standard interface to low-cost peripherals . . .

- 20 ma. current loop TTY interface
- Interface for two audio cassette recorders
- Two audio cassette formats: ASCII KIM-1 compatible and binary, blocked file assembler compatible

ROM RESIDENT ADVANCED INTERACTIVE MONITOR

Advanced features found only on larger systems . . .

- Monitor-generated prompts
- Single keystroke commands
- Address independent data entry
- Debug aids
- Error messages
- Option and user interface linkage

ADVANCED INTERACTIVE MONITOR COMMANDS

- Major Function Entry
- Instruction Entry and Disassembly
- Display/Alter Registers and Memory
- Manipulate Breakpoints
- Control Instruction/Trace
- Control Peripheral Devices
- Call User-Defined Functions
- Comprehensive Text Editor

LOW COST PLUG-IN ROM OPTIONS

- 4K Assembler—symbolic, two-pass , **A65-010 $79.00**
- 8K BASIC Interpreter **A65-020 $99.00**

POWER SUPPLY SPECIFICATIONS

- +5 VDC ± 5% regulated @ 2.0 amps (max)
- +24 VDC ± 15% unregulated @ 2.5 amps (peak) 0.5 amps average

PRICE: $389.00 (1K RAM) **$439.00 (4K RAM)**

Plus $4.00 UPS (shipped in U.S. must give ***street*** address), $10 parcel post to APO's, FPO's, Alaska, Hawaii, Canada, $25 air mail to all other countries

AIM 65 USER MANUAL $5.00 plus $1.50 shipping & handling.

We manufacture a complete line of high quality expansion boards. Use reader service card to be added to our mailing list, or U.S. residents send $1.00 (International send $3.00 U.S.) for airmail delivery of our complete catalog.

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12" black & white monitor. Wide band, will display 80 x 24 char. 10K or 75Ω input impedance, composite video input. Transformer power supply.
Shpt. Wt. 30#
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Used with all computers such as: TRS-80, Apple, and many others.
Complete manual $5.00.

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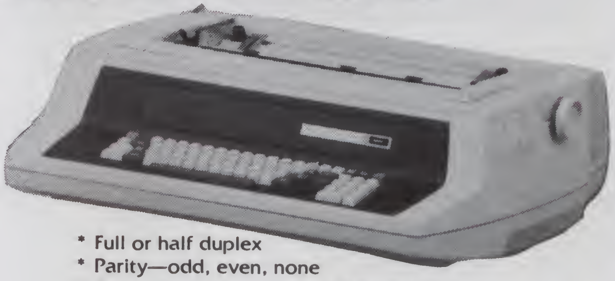
Only Selectronics could bring you this unbelievable opportunity to own the finest high-quality KSR terminal ever made. These machines originally listed for more than $4200. Check these outstanding features:

- * Letter quality printing with upper and lowercase
- * Microprocessor controlled
- * 76-key alphanumeric keyboard with 10-key numeric pad
- * EIA RS232C asynchronous serial interface
- * 40 cps print rate
- * 132 character buffer



- * Full or half duplex
- * Parity—odd, even, none
- * Replacable print cups and elements

Excellent Condition—$750.00 F.O.B. our warehouse.
Shpt. Wt. 90#

HAZELTINE 1200 TERMINALS

24 x 80 character display; 5x7 dot matrix, Raster Scan, full ASCII keyboard; dc to 9600 baud, RS-232 interface; odd, even or no parity enable; full/half duplex, MOS-shift register memory with constant refresh.

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ONLY $200.00

Also HAZELTINE 1000's

12 x 80 character baud rate 300
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ACOUSTIC COUPLE MODEM

Originate only 300 baud,
full or half duplex
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Sold out

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14-7/8 x 11, one-part. 3000 sheets per carton.
$24.00 per carton, 5 for $100.00
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6 digit numeric display boards with 6 FND 507. Common anode displays and 10 red LED's. With drivers & logic for multiplexed operation. Price: $5.00 ea. or 6/$25.00.

All items have been thoroughly checked and are in excellent working condition.

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SELECTRONICS

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215-468-4645
215-468-7891

1206 S. Napa Street • Philadelphia PA 19146

Penna. resident please add 6% sales tax. **ALL PRICES ARE F.O.B.** our warehouse. Phila. PA. All merchandise accurate as to description to the best of our knowledge. Your purchase money refunded if not satisfied. Min. order $10.00.

Here we grow again !!!

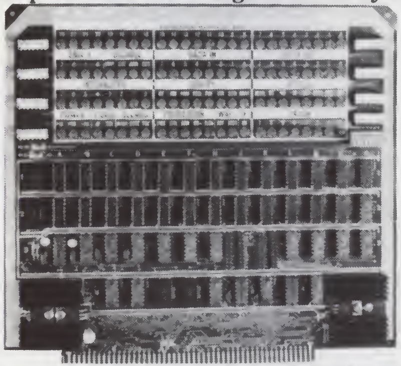
Grand Opening Sale

We're celebrating the latest addition to Jade's Retail Division - our new store located in Woodland Hills at 21800 Ventura Blvd.

New from Jade

The Bus Probe

nexpensive S-100 Diagnostic Analyzer



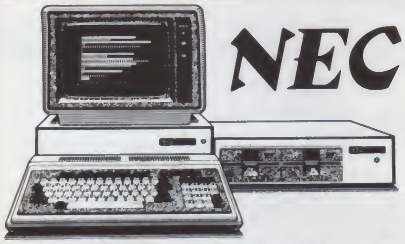
So your computer is down. And you don't have an oscilloscope. And you don't have a front panel... You're not alone - most computers have their occasional bad days. But without diagnostic equipment such as an oscilloscope (expensive!) or a front panel (expensive!), it can be very difficult to pinpoint the problem. Even if you have an extender board with a superfast logic probe, you can't see more than one signal at a time. You're stuck, right?

Not anymore; Jade is proud to offer our cost-effective solution to the problems mentioned above: **THE BUS PROBE.**

Whether you're a hobbyist with a cantankerous kluge or a field technician with an anxious computer owner breathing down your neck, you'll find THE BUS PROBE speeds your repair time remarkably. Just plug in THE BUS PROBE and you'll be able to see *all* the IEEE S-100 signals in action. THE BUS PROBE allows you to see inputs, outputs, memory reads and writes, instruction fetches, DMA channels, vectored interrupts, 8 or 16 bit wide data transfers, plus the three bus supply voltages.

An on-board pulse generator can provide repetitive resets, interrupts, or wait states, for trouble shooting.

TSX-200B	*Bare board*	**$59.95**
TSX-200K	*Kit*	**$119.95**
TSX-200A	*A&T*	**$149.95**



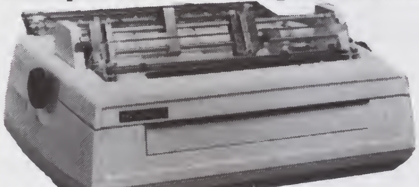
4 MHz Z-80 CPU, 80 x 25 display with graphics and 8 colors, 32K RAM, 24K ROM, parallel/serial/cassette interfaces, upper/lower case, numeric keypad, 10 special function keys, uses CP/M 2.2.

NEC-8001A	*32K CPU/keyboard* ..	**$1095.00**
NEC-8012A	*I/O with 32K RAM* ...	**$695.00**
NEC-8031A	*Dual disk unit*	**$1095.00**
VDM-651200	*12" green CRT*	**$269.95**
NEC-1202D	*Hi-res RGB color CRT*	**$1045.00**
VDC-651212	*12" color monitor*	**$479.95**
NEC-9010S	*CP/M 2.2 for NEC*	**$150.00**
NEC-90005	*Gen. accting softwr* ...	**$375.00**

Intersell

Sellum I

NEC Spinwriter w/ Intelligent Controller



Standard serial, Centronics parallel, and current loop interfaces • Selectable baud rates 50 to 19,200 • Automatic bidirectional printing • Logic seeking • 650 character buffer with optional 16K buffer • 55 characters per second print speed • Comes with vertical forms tractor, ribbon, thimble and cable • Diablo compatible software • Available with or without optional front panel

PRD-55511	*1K no front panel*	**$2795.00**
PRD-55512	*16K no front panel* ..	**$2895.00**
PRD-55515	*1K w/front panel*	**$2995.00**
PRD-55516	*16K w/front panel* ...	**$3095.00**

Intersell NEC 3500Q

Intersell has announced that, available in September, they will offer a version of the new NEC Model 3500Q Spinwriter (30 cps) that will bring to the customer the same standard features as the Sellum I (except the tractor assembly which is optional on the 3500Q) but incorporating the added features of the NEC Model 3500Q

PRD-55351	*3500Q 1K*	**$1995.00**
PRD-55352	*3500Q 16K*	**$2095.00**
PRA-55100	*Deluxe tractor option* ..	**$300.00**

JADE

Disk Sub-Systems

Shugart, Siemens, Qume

Handsome metal cabinet with proportionally balanced air flow system • Rugged dual drive power supply • Power cable kit • Power switch, line cord, fuse holder, cooling fan • Never-Mar rubber feet • All necessary hardware to mount 2-8" disk drives, power supply, and fan • Does not include signal cable

Dual 8" Subassembly Cabinet

END-000420	*Bare cabinet*	**$59.95**
END-000421	*Cabinet kit*	**$225.00**
END-000431	*A & T*	**$359.95**

8" Disk Drive Subsystems
Single Sided, Double Density

END-000423	*Kit w/2 FD100-8Ds* .	**$924.95**
END-000424	*A & T w/2 FD100-8Ds*	**$1124.95**
END-000433	*Kit w/2 SA-801Rs* ...	**$999.95**
END-000434	*A & T w/2 SA-801Rs*	**$1195.00**

8" Disk Drive Subsystems
Double Sided, Double Density

END-000426	*Kit w/2 DT-8s*	**$1224.95**
END-000427	*A & T w/2 DT-8s* ...	**$1424.95**
END-000436	*Kit w/2 SA-851Rs* ..	**$1495.00**
END-000437	*A & T w/2 SA-851Rs*	**$1695.00**

-Special Sale Price-

QUME DT-8

8" Double-Sided, Double-Density Disk Drive

1 Drive ...	**$524.95 each**
2 Drives .	**$499.95 each**
10 Drives	**$479.95 each**

Jade Part Number MSF-750080

SIEMENS 8"

8" Single-Sided, Double-Density Disk Drive

1 Drive ...	**$384.95 each**
2 Drives .	**$349.95 each**
10 Drives	**$324.95 each**

Jade Part Number MSF-201120

Shugart 801R

8" Single-Sided, Double-Density Disk Drive

1 Drive ...	**$394.95 each**
2 Drives .	**$389.95 each**

Jade Part Number MSF-10801R

MPI B-51

5¼" Single-Sided, Double-Density Disk Drive

1 Drive ...	**$234.95 each**
2 Drives .	**$224.95 each**
10 Drives	**$219.95 each**

Jade Part Number MSM-155100

END-000213	*Case & power supply*	**$74.95**

Micro-Sci

Apple Disk Drives

Increased Capacity - Decreased Price

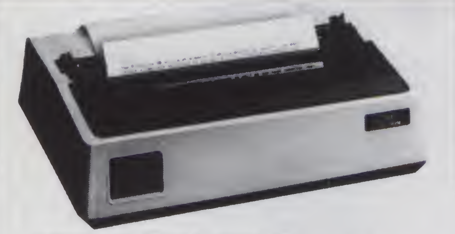
40 or 70 track drives • operates with DOS 3.2 and 3.3, Language System, and the Z80 Softcard • 40 and 70 track drives may be mixed on your Apple II • With two 40 track drives you get a 12.5% increase in capacity, 300% improvement in track-to-track access, and save about 15% • With two 70 track drives instead of four 35 track drives you get the same capacity, 300% improvement in track-to-track access time, and save about 45%.

IOD-2340A	*A-40 with cable*	**$399.95**
IOD-2370A	*A-70 with cable*	**$529.95**
IOD-2300A	*Micro-sci controller*	**$89.95**

Grand Opening Sale

★★★★★★ *San Diego* ★★★★★★ *Hawthorne* ★★★★★★ *Woodland Hills* ★★★★★★

Printers



BETTER THAN EPSON ! - Okidata

Microline 82A *80/132 column,* ***120 CPS****, 9 x 9 dot matrix, friction feed, pin feed, adjustable tractor feed (removable), handles 4 part forms up to 9.5" wide, rear & bottom feed, paper tear bar, 100% duty cycle/200,000,000 character print head, bi-directional/logic seeking, both serial & parallel interfaces included, front panel switch & program control of 10 different form lengths, uses inexpensive spool type ribbons, double width & condensed characters, true lower case descenders & graphics*

PRM-43082	*with FREE tractor*	**$544.95**

Microline 83A *132/232 column, 120 CPS, handles forms up to 15" wide, plus all the features of the 82A.*

PRM-43083	*with FREE tractor*	**$774.95**
PRA-27081A	*Apple card*	**$39.95**
PRA-27082A	*Apple cable*	**$19.95**
PRA-27087A	*TRS-80 cable*	**$24.95**
PRA-43080	*Extra ribbons pkg. of 2*	**$9.95**

INEXPENSIVE PRINTERS - Epson

MX-70 *80 column, 80 CPS, 5 x 7 dot matrix, adjustable tractor feed, & graphics*

PRM-27070	*List $459*	**$399.95**

MX-80 *80 column, 80 CPS, bi-directional/logic seeking printing, 9 x 9 dot matrix, adjustable tractor feed, & 64 graphics characters*

PRM-27080	*List $645*	**$474.95**

MX-80FT *same as MX-80 with friction feed added.*

PRM-27082	*List $745*	**$574.95**

MX-100 *132 column, correspondence quality, graphics, up to 15" paper, friction feed & adjustable tractor feed, 9 x 9 dot matrix, 80 CPS.*

PRM-27100	*List $945*	**$795.00**
PRA-27084	*Serial interface*	**$69.95**
PRA-27088	*Serial intf & 2K buffer*	**$144.95**
PRA-27081	*Apple card*	**$74.95**
PRA-27082	*Apple cable*	**$22.95**
PRA-27086	*IEEE 488 card*	**$52.95**
PRA-27087	*TRS-80 cable*	**$32.95**
PRA-27085	*Graftrax II*	**$95.00**
PRA-27083	*Extra ribbon*	**$14.95**

Dual-Mode 200 - Malibu

200 CPS/9 x 9 matrix or 70 CPS/19 x 18 matrix for letter quality, stores up to 12 different fonts, hi-res dot graphics, single sheet and tractor feed, RS-232C and parallel interfaces

PRM-35200	*Dual-Mode 200*	**$2695.00**

16K Atari . . . $359.95

ATARI 800 - Atari

Complete personal computer with high resolution color graphics, built-in RF modulator, 4 controller ports, internal speaker, 16K RAM & 8K ROM

SYO-2080A	*16K Atari 800*	**$759.95**
Atari 800 with 32K of RAM		**$799.95**
Atari 800 with 48K of RAM		**$849.95**
SYO-2040A	*16K Atari 400*	**$359.95**
MSM-330810	*Disk drive*	**$595.00**
MSM-330815	*Dual drive*	**$1395.00**
IOX-5050A	*850 interface*	**$199.95**
MEX-16853K	*16K RAM module*	**$69.95**
SFI-241011005	*Visicalc*	**$184.95**

Accessories for Apple

16K MEMORY UPGRADE

Add 16K of RAM to your TRS-80, Apple, or Exidy in just minutes. We've sold thousands of these 16K RAM upgrades which include the appropriate memory chips (as specified by the manufacturer), all necessary jumper blocks, fool-proof instructions, and our 1 year guarantee.

MEX-16100K	*TRS-80 kit*	**$25.00**
MEX-16101K	*Apple kit*	**$25.00**
MEX-16102K	*Exidy kit*	**$25.00**

16K RAM CARD - for Apple II

Expand your Apple to 64K, 1 year warranty

MEX-16500A	*Save $70.00 !!!*	**$129.95**

Z-80* CARD for APPLE

Two computers in one, Z-80 & 6502, more than doubles the power & potential of your Apple, includes Z-80 CPU card, CP M 2.2, & BASIC-80*

CPX-30800A	*A & T*	**$299.95**

8" DISK CONTROLLER

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CPM 2.2, Shugart & Qume compatible

IOD-2700A	*A & T*	**$499.95**

8" DRIVES for APPLE

Controller, DOS, two 8" double densisty drives, cabinet, power supply, & cables

Special Package Price	*Kit*	**$1399.95**

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock calendar, serial interface, & parallel interface - all on one card.

IOX-2300A	*A & T*	**$199.95**

APPLE CLOCK - Cal Comp Sys

Real time clock w/battery back-up

IOK-2030A	*A & T*	**$109.95**

PRINTER INTERFACE - C.C.S.

Centronics type I/O card w/ firmware

IOI-2041A	*A & T*	**$99.95**

AIO, ASIO, APIO - S.S.M.

Parallel & serial interface for your Apple (see Byte pg 11)

IOI-2050K	*Par & Ser kit*	**$139.95**
IOI-2050A	*Par & Ser A & T*	**$169.95**
IOI-2052K	*Serial kit*	**$89.95**
IOI-2052A	*Serial A & T*	**$99.95**
IOI-2054K	*Parallel kit*	**$69.95**
IOI-2054A	*Parallel A & T*	**$89.95**

A488 - S.S.M.

IEEE 488 controller, uses simple basic commands, includes firmware and cable, 1 year guarantee, (see April Byte pg 11)

IOX-7488A	*A & T*	**$399.95**

Accessories for TRS-80

DISK DRIVES for TRS-80

23% more storage, 8 times faster, 40 track with free patch, 120 day warranty.

MSM-12410C	*Save $125.00 !!!*	**$325.00**

8" DISK DRIVES for MODEL II

2 double density drives with cabinet, power supply, & cables

END-000433	*Kit*	**$1050.00**
END-000434	*Assembled*	**$1250.00**
WCA-5036A	*Cable (required)*	**$29.95**

EPROM ERASERS

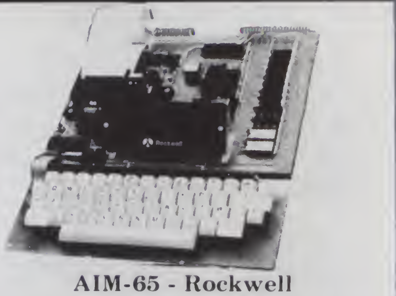
L.S. Engineering UV eraser for up to 48 EPROMs

XME-3200	*A & T*	**$39.99**

Spectronics hi intensity industrial eraser

XME-3100	*Without timer*	**$69.50**

Single Board Computers



AIM-65 - Rockwell

6502 computer with alphanumeric display, printer, & keyboard, and complete instructional manuals

CPK-50165	*1K AIM*	**$424.9**
CPK-50465	*4K AIM*	**$474.95**
SFK-74600008E	*8K BASIC ROM*	**$69.95**
SFK-64600004E	*4K assembler ROM*	**$39.95**
PSX-030A	*Power supply*	**$64.95**
ENX-000002	*Enclosure*	**$54.95**

1K AIM, 8K BASIC, power supply, & enclosure

Special package price		**$659.95**

Z-80* STARTER KIT - SD Systems

Complete Z-80 computer with RAM, ROM, I O, display keyboard, manual, and kluge area.*

CPS-30010K	*Kit*	**$369.95**
CPS-30010A	*A & T*	**$459.95**

SYM-1 - Synertek Systems

Single board computer with 1K of RAM, 1K of ROM, key-pad LED display, 20ma & cassette interface on board.

CPK-50020A	*A & T*	**$249.95**

Video Terminals

AMBER SCREEN - Volker Craig

Detachable keyboard, amber on black display, 7 x 9 do matrix, 10 program function keys, 14 key numeric pad, 12 non-glare screen, 50 to 19,200 baud, direct cursor control auxiliary bi-directional serial port

VDT-351200	*List $795.00*	**$645.00**

VIEWPIONT - ADDS

Detachable keyboard, serial RS232C interface, baud rates from 110 to 19,200, auxiliary serial output port, 24 x 80 display

VDT-501210	*Sale Priced*	**$639.95**

TELEVIDEO 950

Detachable keyboard, split screen with line lock, etched CRT, programmable function keys, on-screen status line, buffered auxiliary port, 14 x 10 dot matrix, self test, serviced nation-wide by General Electric

VDT-901250	*List $1195.00*	**$995.00**

Video Monitors

HI-RES 12" GREEN - Zenith

15 MHz bandwidth, 700 lines/inch, P31 green phosphor, switchable 40 or 80 columns, small, light-weight & portable.

VDM-201201	*List price $150.00*	**$118.95**

Leedex / Amdek

Reasonably priced video monitors

VDM-801210	*Video 100 12" B&W*	**$139.95**
VDM-801230	*Video 100-80 12" B& W*	**$179.95**
VDM-801250	*12" Green Phospor*	**$169.95**
VDC-801310	*13" Color I*	**$379.95**

12" COLOR MONITOR - NEC

Hi-res monitor with audio & sculptured case

VDC-651212	*Color Monitor*	**$479.95**

12" GREEN SCREEN - NEC

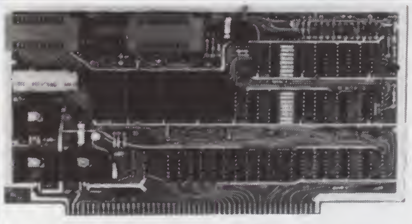
20 MHz, P31 phosphor video monitor with audio, exceptionally high resolution - A fantastic monitor at a very reasonable price

VDM-651200	*12" monitor*	**$269.95**

Grand Opening Sale

★★★★★★ San Diego ★★★★★★ Hawthorne ★★★★★★ Woodland Hills ★★★★★★

S-100 PROM Boards



PB-1 - S.S.M.

2708, 2716 EPROM board with built-in programmer

EM-99510K	*Kit*	**$154.95**
EM-99510A	*A & T*	**$219.95**

PROM-100 - SD Systems

2708, 2716, 2732, 2758, & 2516 EPROM programmer

EM-99520K	*Kit*	**$219.95**
EM-99520A	*Jade A & T*	**$269.95**

EPROM BOARD - Jade

16K or 32K uses 2708's or 2716's, 1K boundary

EM-16230K	*Kit*	**$79.95**
EM-16230A	*A & T*	**$119.95**

S-100 Video

VB-3 - S.S.M.

) characters x 24 lines expandable to 80 x 48 for a full page text, upper & lower case, 256 user defined symbols, 160 x 92 graphics matrix, memory mapped, has key board put.

OV-1095K	*4 MHz kit*	**$349.95**
OV-1095A	*4 MHz A & T*	**$439.95**
OV-1096K	*80 x 48 upgrade*	**$39.95**

VDB-8024 - SD Systems

0 x 24 I/O mapped video board with keyboard I/O, and n-board Z-80A.*

OV-1020K	*Kit*	**$399.95**
OV-1020A	*Jade A & T*	**$459.95**

VIDEO BOARD - S.S.M.

4 characters x 16 lines, 128 x 48 matrix for graphics, full pper lower case ASCII character set, numbers, symbols, nd greek letters, normal/reverse/blinking video, S-100.

OV-1051K	*Kit*	**$149.95**
OV-1051A	*A & T*	**$219.95**
OV-1051B	*Bare board*	**$34.95**

Motherboards

ISO-BUS - Jade

Silent, simple, and on sale - a better motherboard

	6 Slot (5¼" x 8⅝")	
MBS-061B	*Bare board*	**$19.95**
MBS-061K	*Kit*	**$39.95**
MBS-061A	*A & T*	**$49.95**
	12 Slot (9¾" x 8⅝")	
MBS-121B	*Bare board*	**$29.95**
MBS-121K	*Kit*	**$69.95**
MBS-121A	*A & T*	**$89.95**
	18 Slot (14½" x 8⅝")	
MBS-181B	*Bare board*	**$49.95**
MBS-181K	*Kit*	**$99.95**
MBS-181A	*A & T*	**$139.95**

Mainframes

MAINFRAME - Cal Comp Sys

12 slot S-100 mainframe with 20 amp power supply

ENC-112105	*Kit*	**$329.95**
ENC-112106	*A & T*	**$399.95**

DISK MAINFRAME - N.P.C.

Holds 2 8" drives and a 12 slot S-100 system. Attractive metal cabinet with 12 slot motherboard & card cage, power supply, dual fans, lighted switch, and other professional features

ENS-112325	*with 25 amp p.s.*	**$699.95**

S-100 Memory

MEMORY BANK - Jade

4 MHz, S-100, bank selectable, expandable from 16K to 64K

MEM-99730B	*Bare board*	**$49.95**
MEM-99730K	*Kit, no RAM*	**$199.95**
MEM-16730K	*16K kit*	**$219.95**
MEM-32731K	*32K kit*	**$239.95**
MEM-48732K	*48K kit*	**$259.95**
MEM-64733K	*64K kit*	**$279.95**
Assembled & tested		add **$50.00**

EXPANDORAM II - S D Systems

4 MHz RAM board expandable from 16K to 64K

MEM-16630K	*16K kit*	**$275.95**
MEM-32631K	*32K kit*	**$295.95**
MEM-48632K	*48K kit*	**$315.95**
MEM-64633K	*64K kit*	**$335.95**
Assembled & tested		add **$50.00**

64K RAM - Calif Computer Sys

4 MHz bank port / bank byte selectable, extended addressing, 16K bank selectable, PHANTOM line allows memory overlay, 8080 / Z-80 / front panel compatible.

MEM-64565A	*A & T*	**$575.00**

64K STATIC RAM - Mem. Merch.

64K static S-100 RAM card, 4-16K banks, up to 8 MHz

MEM—64400A	*A & T*	**$825.00**

32K STATIC RAM - Jade

2 or 4 MHz expandable static RAM board uses 2114L's

MEM-16151K	*16K 4 MHz kit*	**$169.95**
MEM-32151K	*32K 4 MHz kit*	**$299.95**
Assembled & tested		add **$50.00**

16K STATIC RAM - Mem Merchant

4 MHz 16K static RAM board, IEEE S-100, bank selectable, Phantom capability, addressable in 4K blocks, "disable-able" in 1K segments, extended addressing, low power

MEM-16171A	*A & T*	**$174.95**

S-100 Disk Controller

DOUBLE-D - Jade

Double density controller with the inside track, on-board Z-80A, printer port, IEEE S-100, can function on an interrupt driven buss*

IOD-1200K	*Kit*	**$299.95**
IOD-1200A	*A & T*	**$375.00**
IOD-1200B	*Bare board*	**$59.95**

VERSAFLOPPY II - SD Systems

New double density controller for both 8" & 5¼"

IOD-1160K	*Kit*	**$339.95**
IOD-1160A	*A & T*	**$379.95**

DOUBLE DENSITY - Cal Comp Sys

5¼" and 8" disk controller, single or double density, with on-board boot loader ROM, and free CP/M 2.2 and manual set.*

IOD-1300A	*A & T*	**$369.95**

S-100 I/O

S.P.I.C. - Jade

Our new I/O card with 2 SIO's, 4 CTC's, and 1 PIO

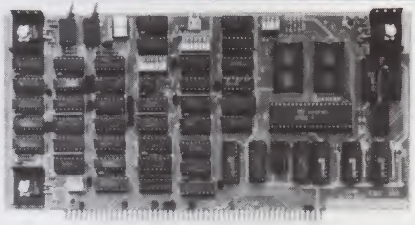
IOI-1045K	*2 CTC's, 1 SIO, 1 PIO*	**$179.95**
IOI-1045A	*A & T*	**$239.95**
IOI-1046K	*4 CTC's, 2 SIO's, 1 PIO*	**$219.95**
IOI-1046A	*A & T*	**$299.95**
IOI-1045B	*Bare board w/ manual*	**$49.95**

I/O-4 - S.S.M.

2 serial I/O ports plus 2 parallel I/O ports

IOI-1010K	*Kit*	**$179.95**
IOI-1010A	*A & T*	**$249.95**
IOI-1010B	*Bare board*	**$35.00**

S-100 CPU



CB-2 Z-80 CPU - S.S.M.

2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300K	*Kit*	**$239.95**
CPU-30300A	*A & T*	**$299.95**

2810 Z-80* CPU - Cal Comp Sys

2/4 MHz Z-80A CPU with RS-232C serial I/O port and on-board MOSS 2.2 monitor PROM, front panel compatible.*

CPU-30400A	*A & T*	**$269.95**

SBC-200 - SD Systems

4 MHz Z-80 CPU with serial & parallel I/O ports, up to 8K of on-board PROM, software programmable baud rate generator, 1K of on-board RAM, Z-80 CTC.*

CPC-30200K	*Kit*	**$339.95**
CPC-30200A	*Jade A & T*	**$399.95**

THE BIG Z* - Jade

2 or 4 MHz switchable Z-80 CPU with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600*

CPU-30201K	*Kit*	**$139.95**
CPU-30201A	*A & T*	**$189.95**
CPU-30200B	*Bare board*	**$35.00**

Novation Cat Modem

CAT MODEMS - Novation

CAT *300 baud, acoustic, answer/orginate*

IOM-5200A	*List $189.95*	**$149.95**

D-CAT *300 baud direct connect, answer/orginate*

IOM-5201A	*List $199.95*	**$169.95**

AUTO-CAT *Auto answer/orginate, direct connect*

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- ☐ 1. Apple
- ☐ 2. Atari
- ☐ 3. Exidy
- ☐ 4. Heath
- ☐ 5. Hewlett-Packard
- ☐ 6. North Star
- ☐ 7. OSI
- ☐ 8. PET/CBM
- ☐ 9. SWTP
- ☐ 10. TI
- ☐ 11. TRS-80
- ☐ 12. Other________________

How much have you invested in hardware (including peripherials)?
- ☐ 1. $1000-$2000
- ☐ 2. $2001-$3000
- ☐ 3. $3001-$4000
- ☐ 4. More than $4000

What will be your next major Hardware purchase?
- ☐ 1. Printer
- ☐ 2. Modem
- ☐ 3. Disk System
- ☐ 4. Other________________

On average, how many of each issue's program listings do you actually type into your micro?
- ☐ 1. 0-2
- ☐ 2. 3-5
- ☐ 3. 6-8
- ☐ 4. 9 or more

How much have you spent on software?
- ☐ 1. Less then $100
- ☐ 2. $100-$250
- ☐ 3. $251-$500
- ☐ 4. $501-$$1000
- ☐ 5. Over $1000

How do you acquire your software?
- ☐ 1. I program it myself
- ☐ 2. From magazines
- ☐ 3. From friends and fellow programmers
- ☐ 4. From software houses

From what companies have you purchased software?
- ☐ 1. Hayden
- ☐ 2. Hewlett-Packard
- ☐ 3. Instant Software
- ☐ 4. Microsoft
- ☐ 5. Personal Software
- ☐ 6. SAMS
- ☐ 7. Other________________

H. To what types of software users groups do you belong?
- ☐ 1. Hardware exclusive
- ☐ 2. General club
- ☐ 3. College organization
- ☐ 4. Other________________

I. How many people read your copy of *Kilobaud Microcomputing?*
- ☐ 1. 1
- ☐ 2. 2
- ☐ 3. 3
- ☐ 4. 4 or more

J. Where did you obtain this copy of *Kilobaud Microcomputing*?
- ☐ 1. Subscription
- ☐ 2. Newsstand
- ☐ 3. Computer store
- ☐ 4. Friend
- ☐ 5. Other________________

K. Which cover style do you prefer for this magazine?
- __ 1. The old table of contents cover
- __ 2. The newer picture-type cover
- __ 3. Don't care
- __ 4. Other ideas________________

L. On a scale of 0 (no interest) to 5 (most interest) please rate your interest in the following specialized article themes:
- ☐ 1. Artificial Intelligence
- ☐ 2. Robotics
- ☐ 3. Applications
- ☐ 4. Business
- ☐ 5. Speech Synthesis
- ☐ 6. Languages
- ☐ 7. Other interests________________

M. I would like to see more of the following news topics covered:
- ☐ 1. **New Product Announcements**
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- ☐ 4. **Personal Profiles**
- ☐ 5. **Other**________________

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LETTERS TO THE EDITOR

(from page 30)

I am in complete agreement with Bob Stratton's comments, but would like to clarify a few points. I don't believe the STD bus will ever replace the S-100 either, and the purpose of the article was to acquaint readers with these new cards as a viable alternative to S-100. Granted, Pro-Log had the original idea but the bus was *developed* jointly by Pro-Log and Mostek. The packaged system offered by Pro-Log has no mass storage or extensive operating system, which basically limits it to engineering development.

The 8088 CPU Bob mentioned is not a true implementation of the STD bus, and peripheral cards must be chosen very carefully to ensure compatibility. There are several 16-bit implementations under way but they detract from the original purpose of the bus, to standardize all eight-bit machines.

As more of these cards and systems filter into homes and small businesses, standardization and compatibility will play a crucial role in its acceptance. That's one lesson it took S-100 manufacturers several years to finally figure out.

Don Langford
Hunstville, AL

Osborne the Obnoxious

Osborne the obnoxious, you betcha!

My local Osborne dealer wanted a $20 check-out fee to ascertain the machine wasn't DOA. Thanks but no thanks. Are there any others out there that have reacted similarly? Hidden charges may be OK but such a blatant disregard toward a paying customer I can't stomach.

Duncan Moyer
Auburn, CA

Alternatives to Ma Bell

A number of recent articles and news clips have correctly pointed out that there are a number of alternatives to the Bell System for low-cost toll telephone service. However, these articles have not mentioned Western Union's Metro I Low-Cost Toll Telephone Service.

Metro I provides service from the top 45 major metropolitan areas to 145 metropolitan areas. The backbone of the Metro I service offerings is the Western Union transcontinental microwave and satellite transmission network, which allows Western Union to have complete control over the end-to-end performance of our service.

The Metro I approach to the market is a combination of the best price and the most complete service. We have 24-hour per day computer monitoring of service quality and a grade of service which assures that 99 of 100 calls attempted will be completed on the first attempt. (Of course, this excludes situations where the called number is busy or does not answer.)

With AT&T's 16 percent toll telephone rate increase, two successive WATS rate increases, increasing many users' bills by 50 percent to 100 percent, and a 35 percent private line increase, I am sure your readers will want to know about the alternatives.

Joseph E. Lopez
Senior Product Manager
Specialized Communications
Western Union Telegraph Company

She Loves Me

Why in this day of micromarvels should the tormented lover bother to expend his energy plucking the petals from flowers to answer that age old query, "She loves me, she loves me not . . . ."? Now with the aid of modern technology (i.e., microcomputer with BASIC) you can know your fate in seconds. See Listing 1.

```
10 PRINT "PROGRAM FOR THE
   LOVELORN"
20 PRINT "SAVES TIME, EFFORT
   AND AGGRAVATION"
30 PRINT "IS THE OBJECT OF
   YOUR DESIRE MALE(0) OR
   FEMALE(1)?"
40 INPUT Y
50 I = INT(100*RND)
60 IF Y = 1 GO TO 200
100 GOSUB 500
110 I = I - 1
120 IF I = 0 GO TO 700
130 GOSUB 520
140 I = I - 1
160 IF I = 0 GO TO 600
170 GO TO 100
200 GOSUB 400
210 I = I - 1
220 IF I = 0 GO TO 700
230 GOSUB 420
240 I = I - 1
250 IF I = 0 GO TO 600
260 GO TO 200
400 PRINT "SHE LOVES ME"
410 RETURN
420 PRINT "SHE LOVES ME NOT"
430 RETURN
500 PRINT "HE LOVES ME"
510 RETURN
520 PRINT "HE LOVES ME NOT"
530 RETURN
600 PRINT "SORRY KIDDO!"
610 PRINT "BETTER LUCK NEXT
    TIME"
620 PRINT "TRY AGAIN? NO=0,
    YES=1
630 INPUT Z
640 IF Z = 1 GO TO 50
650 GO TO 1000
700 PRINT "WAS THERE EVER ANY
    DOUBT?"
1000 END
```

Listing 1

Many Thanks

I would like to thank David S. Ailes of Winter Park, FL, for his kind comments in the August Letters to the Editor on my thoughts expressed in Perspectives in the June *Microcomputing*.

Many of us out here would like to hear more about what he, and others like him, have been trying to do, and the problems he has encountered along the way. Some of us ought to be able to help him get full use out of his Apple computer.

I am also looking forward to *Desktop Computing*, which is targeted to bring together the people who need help and those who can give it. I think they call that user-friendly. By helping those who are just beginning to use micros, *Desktop Computing* also ought to swell the ranks of readership of *Microcomputing* with those ready to graduate.

Martin Klaver
Sicklerville, NJ

CALENDAR

Microcomputer Graphics Workshop

A one-day workshop designed as a practical preparation for making intelligent purchasing decisions will be held in Boston on Nov. 14. It will present an overview of applications, graphics features, system integration considerations, price ranges and information sources. Registration is $20.

For information, call or write Jean L. Graef, Cambridge Development Laboratory, 36 Pleasant St., Watertown, MA 02172 (617-926-0869).

COMDEX Show

The third annual COMDEX Conference and Exposition for independent sellers (ISOs) of small computer products will be held at the Las Vegas (NV) Convention Center Nov. 19–22. The conference will feature business, marketing and financial topics of relevance to ISOs.

For further information, write The Interface Group, 160 Speen St., Framingham, MA 01701 or call 800-225-4620 (in Massachusetts, 617-879-4502).

Philadelphia Area Computer Show

A show sponsored by the Philadelphia Area Computer Society will feature applications of small computers in education, business and leisure. Show dates: Nov. 12–14.

For further information contact Stephen A. Longo, Ph.D., Physics Department, La Salle College, Philadelphia, PA 19141 (215-951-1255).

California Computer Faire

The Silicon Gulch Games Faire & AppleFest will focus on electronic products for entertainment and Apple-related products. Scheduled for Nov. 21–22, at the San Jose Convention Center.

For further information, contact Computer Faire, 333 Swett Road, Woodside, CA 94062 (415-851-7075).

Symposium on Small Computers in the Arts

A wide range of presentations are planned to bring together people interested in using small computers in the audio and visual arts. The symposium will be held at the University City Holiday Inn on the campus of the University of Pennsylvania on Nov. 20–22.

For information, write to Symposium on Small Computers in the Arts, Box 1954, Philadelphia, PA 19105 (215-243-8109).

Teleconferencing Technologies Seminar

The Teleconferencing Technologies Seminar will be held at the Hilton Harvest House, Boulder, CO, on Dec. 7 and 8, 1981. The seminar will focus on how to use teleconferencing to conduct business transactions and improve effectiveness and decision-making. Demonstrations of computer, video and audio teleconferencing will be conducted, offering hands-on experience.

The seminar is jointly sponsored by Cross Communications Co. and Colorado Video Inc.

The cost of the seminar is $395, exclusive of meals and housing.

For further information contact Cross Communications Co., 934 Pearl, Boulder, CO 80302 (303-499-8888).

International Computer Music Conference

The 1981 International Computer Music Conference will be held Nov. 5–8, 1981, in Denton, TX.

For further information contact Larry Austin, School of Music, North Texas State University, Denton, TX 76203 (817-788-2791).

Consumer Electronics Show

The winter International Electronics Show will be held at the Las Vegas Convention Center Jan. 7–10.

For further information contact William T. Glasgow, Vice President, Consumer Electronics Shows, Two Illinois Center, Suite 1607, 233 North Michigan Ave., Chicago, IL 60601 (312-861-1040).

Micros in Education

Arizona State University is hosting the tenth annual Math/Science Conference on Jan. 15 and 16, 1982. The conference will focus on the microcomputer as a tool for instruction, as a research instrument and as an information manager.

For further information contact Nancy Watson, Conference Codirector, 203 Payne Hall, Arizona State University, Tempe, AZ 85287.

National Careers for the Disabled Symposium

The first National Careers for the Disabled Symposium will be sponsored by Commodore Business Machines, Inc., in association with Careers for the Disabled, Inc. The symposium will be held on Dec. 4–6, 1981, at the Convention Center in Baltimore, MD.

For additional information contact Careers for the Disabled, 261 Madison Ave., Suite 1102, New York, NY 10016.

NM Computer Fair

The New Mexico Computer Society will host the third annual New Mexico Computer Fair Saturday, Nov. 14, 1981, at the Albuquerque Civic Auditorium from 10 AM until 6 PM. There will be no charge for admission. For more information call Ron Benninghoff (505-831-3683 or 505-836-0065 after 4 PM Mountain time).

Computer Electronics Flea Market

The second annual SCARA Computer Electronics Flea Market will be held on Nov. 8, 1981, from 10 AM to 4 PM at the North Haven Recreation Center on Linseley St. in North Haven, CT. Refreshments will be served. Sellers' spaces are $5. Admission is $1, free for children under 12 with an adult. Special arrangements are available for dealers. Send check or M.O. (payable to SCARA) to PO Box 81, North Haven, CT 06473. SCARA is a nonprofit organization.

Texas Computer Show Postponed

James E. Myles, group show manager for Intercontinental Trade Shows Inc., has announced that the Texas Computer Show, scheduled to take place in the Dallas Convention Center from Jan. 20–22, 1982, has been postponed until March 9–11, 1983.

For more information contact James E. Myles (416-252-7791) or Catherine Manor (214-761-9108).

FORTH Interest Group National Convention

The FORTH Interest Group (FIG) announced the scheduling of its National Convention to be held Nov. 28, 1981, 9 AM–6 PM at the Santa Clara Marriott Hotel. This one day convention will include presentations, workshops, hands-on equipment and a number of vendor exhibits. An evening dinner will follow the day's activities and will feature a speaker. Registration is $3 with dinner extra.

The theme of the convention this year is education and the FORTH language and FORTH program applications. Papers are being solicited for presentation at the convention. Those wishing to present papers or exhibit should send a letter of intent to Convention Chairman, FORTH Interest Group, PO Box 1105, San Carlos, CA 94070.

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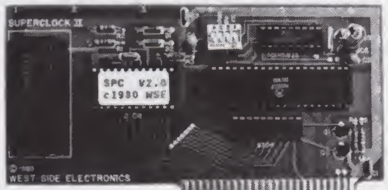
A COMPLETE CLOCK/CALENDAR SYSTEM FOR THE APPLE II.



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TIME-CLOCK II program automatically keeps track of the time you spend on your computer for each job, client, program, etc. Then prints out a detailed report. Requires SUPERCLOCK II, Applesoft, and disk $30

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Apple, Apple II, and Applesoft are trademarks of Apple Computer, Inc.

MULLEN

S-100 PRODUCTS

1 EXTENDER BOARD WITH LOGIC PROBE $89 assm/tested
with these features for use in testing your S-100 boards.

- Logic probe with display shows; (H) for TTL logic high, (L) for low, (O) for open or 3-state, and (P) for pulse.
- Pulse catcher switch latches (P) aids in detecting infrequent pulses.
- Jumper links in +8 and ±16 volt lines allow current measurement, switching and fusing.
- Interlaced signal and ground traces reduce noise.
- Pushbutton reset allows restarting test programs.
- Formed leads on both sides of the edge connector for easy scope probe attachment.
- Prototyping area and regulated 5 volts allows construction of special test circuits on the board.
- Edge connector label shows signal names and pin numbers.
- 5 1/2" high, on quality FR-4 material, solder masked and gold plated on mating surfaces.

2 INDUSTRIAL EXTENDER BOARD $99 assm/tested
saves time where many boards are tested every day.

- ZERO-INSERTION FORCE edge connector.
- Switch and indicator light control +8 and ±16 volt power.
- Pushbutton reset allows restarting test programs.
- Fuses in power lines protect test computer.
- Interlaced signal and ground traces reduce noise.
- Formed leads on both sides of edge connector for easy scope probe attachment.
- Edge connector labels show signal names and pin numbers
- 6" high, on quality FR-4 material, solder masked and gold plated on mating surfaces.

3 RELAY OPTO-ISOLATOR CONTROLLER BOARD $219 assm/tested
for signal switching, or controlling low power devices.

- 8 reed relays.
- 8 opto-isolators with input bridge rectifiers, series resistors, and filter capacitors.
- 256 switch selectable port addresses.
- Removable terminal block for use with up to 16 AWG wire.
- LED indicators in relay drive circuits.
- Socket for input simulation or testing.
- Quality FR-4 material, solder masked & gold plated on bus connector.
- Instructions include programming examples.

4 TRIAC OPTO-ISOLATOR CONTROLLER BOARD $219 assm/tested
for controlling line voltage AC devices.

- 8 triacs with snubbers for controlling inductive loads, and zero crossing isolated drive circuitry.
- 8 opto-isolators with input bridge rectifiers, series resistors, and filter capacitors.
- 256 switch selectable port addresses.
- Removable terminal block for use with up to 16 AWG wire.
- LED indicators in triac drive circuits.
- Socket for input simulation or testing.
- Quality FR-4 material, solder masked & gold plated on bus connector.
- Instructions include programming examples.

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NEW PRODUCTS

Edited by Linda Stephenson

Micro for Those on the Go
Anacom Printers
Multi-User System

A Portable Computer With Battery Backup

Findex, 20775 South Western Ave., Torrance, CA 90501, has introduced a complete microcomputer system in a compact package. The Findex terminal-sized micro combines a keyboard, display, disk drive and printer. It interfaces to a variety of peripherals, such as larger printers or multiple hard-disk drives. Serial, parallel and S-100 bus interfaces are standard; American (Bell 103) and European (CCITT) acoustic couplers are optional. The Findex supports Business BASIC, COBOL, FORTRAN, Pascal, APL and PL/1. Applications software, including a patient accounting system for medical offices, is available from Findex. The computer will operate on 110 V, 200 V or 12 V. Battery backup allows the machine to operate for up to 30 minutes without outside power. The unit sells for $6980 to $20,000, depending on peripherals and software. Reader Service number 490.

The Angel-I development system from E. & U. Engel Consulting.

Paper-Saving Printers

The Anacom-160 and 160Z serial matrix printers are available from Anacom General Corporation, 1116 East Valencia Drive, Fullerton, CA 92631. These printers promise to end wasted forms forever—the paper-handling tractors are below the platen so that preprinted forms, after printing, can be torn within .050 inches of the print line. The head is designed for a print-life in excess of 600 million characters. The ribbon cartridge, which has a 3-million-character life, is clean and easy to handle and can be changed in seconds. The 160Z has dot-addressable graphics, compressed print, serial and parallel interface, x-on, x-off protocol and other features. The Anacom-160 costs $1750; the 160Z costs $2150. Reader Service number 493.

Multi-User System For Program Development

The Angel-I is a multi-terminal word- and data-processing system supporting up to 16 terminals. The CP/M-based Angel-I claims strong software support from over 400 vendors. The system comprises an S-100 bus, Z-80 CPU, 64K byte random access memory, two eight-inch disk drives, an 80-character CRT and a daisywheel printer, and is housed in a formica desk. Price is $7995. Various terminals and peripherals are also available from the supplier.

E. & U. Engel Consulting, 1719 S. Carmelina Ave., Los Angeles, CA 90025. Reader Service number 485.

PROM Blaster for TRS-80 or Apple

Apparat, Inc., 4401 S. Tamarac Parkway, Denver, CO 80237, is offering their

The Findex computer system.

The Anacom-160 printer.

JUDGE THE REST, THEN BUY THE BEST

Only GIMIX offers you **SOFTWARE SWITCHING** between **MICROWARE's OS-9** and **TSC's FLEX**. Plus you get the power of the GMXBUG system monitor with its advanced debugging utility, and memory manipulation routines. A wide variety of languages and other software is available for these two predominant 6809 Disk Operating Systems.

You can order a system to meet your needs, or select from the 6809 Systems featured below.

JUDGE THE FEATURES AND QUALITY OF GIMIX 6809 SYSTEMS

GIMIX' CLASSY CHASSIS™ is a heavyweight aluminum mainframe cabinet with back panel cutouts to conveniently connect your terminals, printers, drives, monitors, etc. A 3 position keyswitch lets you lock out the reset switch. The power supply features a ferro-resonant constant voltage transformer that supplies 8V at 30 amps, + 15V at 5 amps, and − 15V at 5 amps to insure against problems caused by adverse power input conditions. It supplies power for all the boards in a fully loaded system plus two 5 ¼'' drives (yes! even a Winchester) that can be installed in the cabinet. The Mother board has fifteen 50 pin and eight 30 pin slots to give you the most room for expansion of any SS50 system available. 11 standard baud rates from 75 to 38.4K are provided and the I / O section has its own extended addressing to permit the maximum memory address space to be used. The 2 Mhz 6809 CPU card has both a time of day clock with battery back-up and a 6840 programmable timer. It also contains 1K RAM, 4 PROM/ROM/RAM sockets, and provides for an optional 9511A or 9512 Arithmetic Processor. The RAM boards use high speed, low power STATIC memory that is fully compatible with any DMA technique. STATIC RAM requires no refresh timing, no wait states or clock stretching, and allows fast, reliable operation. The system includes a 2 port RS232 serial interface and cables. All GIMIX boards use gold plated bus connectors and are fully socketed. GIMIX designs, manufactures, and tests in-house its complete line of products. All boards are twice tested, and burned in electrically to insure reliability and freedom from infant mortality of component parts. All systems are assembled and then retested as a system after being configured to your specific order.

56KB 2MHZ 6809 SYSTEMS WITH GMXBUX/FLEX/OS-9 SOFTWARE SELECTABLE

With #58 single density disk controller	**$2988.59**
With #68 DMA double density disk controller	**$3248.49**
to substitute Non-volatile CMOS RAM with battery back-up, add	300.00
for 50 Hz export power supply models, add	30.00

Either controller can be used with any combination of 5" and/or 8" drives, up to 4 drives total, have data recovery circuits (data separators), and are designed to fully meet the timing requirements of the controller I.C.s.

5 ¼" DRIVES INSTALLED IN THE ABOVE with all necessary cables

	SINGLE DENSITY		DOUBLE DENSITY		
	Formatted	**Unformatted**	**Formatted**	**Unformatted**	
40 track (48TPI) single sided	199,680	250,000	341,424	500,000	2 for **$700.00**
40 track (48TPI) double sided	399,360	500,000	718,848	1,000,000	2 for **900.00**
80 track (96TPI) single	404,480	500,000	728,064	1,000,000	2 for **900.00**
80 track (96TPI) double	808,960	1,000,000	1,456,128	2,000,000	2 for **1300.00**

Chart shows total capacity in Bytes for 2 drives.

Contact GIMIX for price and availability of 8" floppy disk drives and cabinets; and 5" and 8" Winchester hard disk system.

128KB 2Mhz 6809 DMA Systems for use with TSC's UNIFLEX or MICROWARES's OS-9 Level 2

(Software and drives not included)	**$3798.39**
to substitute 128KB CMOS RAM with battery back-up, add	600.00
for each additional 64KB NMOS STATIC RAM board, add	639.67
for each additional 64KB CMOS STATIC RAM board, add	988.64
for 50 Hz export power supply, add	30.00

***NOTE:** UNIFLEX can not be used with 5" minifloppy drives.*

GIMIX has a wide variety of RAM, ROM, Serial and Parallel I/O, Video, Graphics, and other SS50 bus cards that can be added now or in the future. Phone or write for more complete information and brochure.

THE SUN NEVER SETS ON GIMIX USERS

GIMIX Systems are found on every continent, except Antarctica. (Any users there? If so, please contact GIMIX so we can change this.) A representative group of GIMIX users includes: **Government Research and Scientific Organizations** in Australia, Canada, U.K., and in the U.S.; NASA, Oak Ridge, White Plains, Fermilab, Argonne, Scripps, Sloan Kettering, Los Alamos National Labs, AURA. **Universities:** Carleton, Waterloo, Royal Military College, in Canada; Trier in Germany; and in the U.S.; Stanford, SUNY, Harvard, UCSD, Mississippi, Georgia Tech. **Industrial users** in Hong Kong, Malaysia, South Africa, Germany, Sweden, and in the U.S.; GTE, Becton Dickinson, American Hoechst, Monsanto, Allied, Honeywell, Perkin Elmer, Johnson Controls, Associated Press, Aydin, Newkirk Electric, Revere Sugar, HI-G/AMS Controls, Chevron. **Computer mainframe and peripheral manufacturers,** IBM, OKI, Computer Peripherals Inc., Qume, Floating Point Systems. **Software houses;** Microware, T.S.C., Lucidata, Norpak, Talbot, Stylo Systems, AAA, HHH, Frank Hogg Labs, Epstein Associates, Softwest, Dynasoft, Research Resources U.K., Microworks, Analog Systems, Computerized Business Systems.

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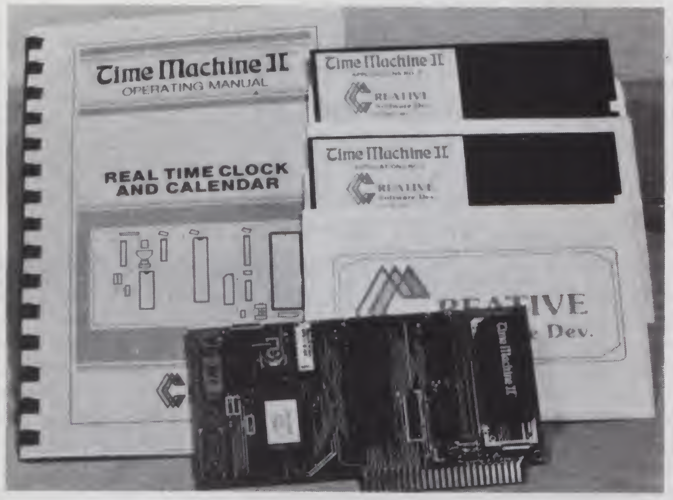


Time Machine II from Creative Software Development.

new PROM burner for the Apple II and TRS-80 Models I and III. The Apparat PROM blasting system (APB) will program nine different EPROMs on the same board. The APB will program model 2704, 2708, 2716, 2732, 2508, 2516 and 2532 EPROMs. The package includes the interface card, a complete set of personality modules, software on disk and a detailed instruction manual. Price is $149. Reader Service number 482.

Real-Time Clock and Calendar

Time Machine II is an intelligent real-time clock and calendar peripheral for the Apple II computer. It is crystal-controlled, and operates at a range of one second to 99 years. The 2048-byte firmware driver uses a dynamic bank switching technique and executes in the same space as other 256-byte clock drivers. Since bank switching occurs dynamically, all options are software selectable. A modified disk operating system adds the time and date to files each time they are modified. The catalog command has also been modified to display the current time and date. Time Machine II is priced at $135.

Creative Software Development, 4657 Thayn Drive, West Valley City, UT 84120. Reader Service number 486.

A Utility Printer

The Model DIP-81A is a reliable dot matrix printer designed for continuous duty cycle. The printer can accept data while printing, and can be readily interfaced with dumb CRT terminals, modems or Teletype replacement equipment. The Model DIP-81A features 7×7 or expanded 14×7 matrix printing, upper/lowercase character set, 100-characters-per-second bidirectional printout, clean ribbon-cartridge loading and a low profile. It uses sheet, roll or fanfold form paper. Centronics-compatible parallel interface is standard. The printer costs $499.

DIP, Inc., 745 Atlantic Ave., Boston, MA 02111. Reader Service number 483.

The DIP-81A dot matrix impact printer.

Five Megabytes of Memory

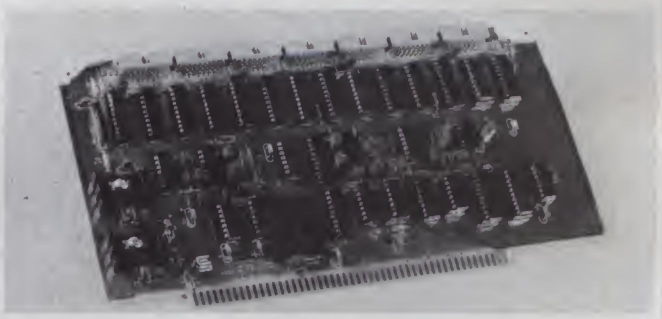
The LS525 5M memory system incorporates a Seagate ST506 5¼-inch Winchester disk drive, the LDOS disk operating system from Logical Systems, a Microcomputer Power Inc. linear power supply and Laredo's LSI 500 series controller. A separate off-board host adapter allows the LS525 to be cross-connected to most CPU and bus types. Up to three additional Winchester disk drives can be added to the system with no software modifications. All TRS-80 programs currently running under TRSDOS or NEWDOS will run under the LDOS operating system. The LS525 memory system is $3750.

Laredo Systems, Inc., 669 Giraudo Drive, San Jose, CA 95111. Reader Service number 491.

High-Speed Four-Port Interface

The CCS Model 2720 lets S-100 system users exchange bidirectional parallel data at high speeds with three peripherals and transmit parallel data to a fourth peripheral. Data is transferred at TTL levels on separate eight-bit input and output pathways, and a four-lines-per-port handshaking scheme ensures thorough communication protocol of both transmitter and receiver. A status register reflects each port's handshake activity so software can monitor the status of the input and output registers. Price is $250.

California Computer Systems, 250 Caribbean Drive, Sunnyvale, CA 94086. Reader Service number 488.



The CCS Model 2720 interface from California Computer Systems.

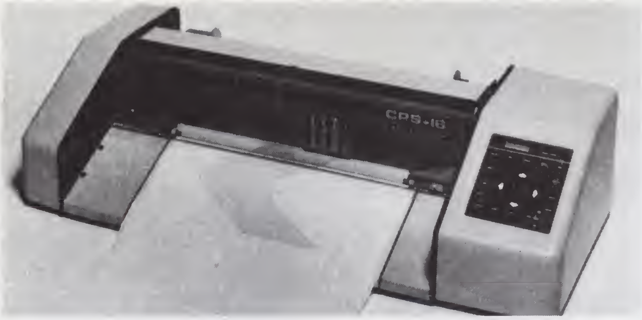
More Memory for Atari

Axlon, Inc., 170 N. Wolfe Road, Sunnyvale, CA 94086, has announced its 128K byte memory system for the Atari 800. The RAMDISK memory system comes with software that makes the new system function like a disk device. The system can also be programmed as bank-selectable random access memory. The RAMDISK memory system and Atari 810 disk drive together are compatible with existing software written for the Atari 800 system. Function for function, the RAMDISK system is up to 20 times faster than the Atari 810. The price is $699. Reader Service number 489.

Table-Top Drum Plotter

The CPS-16 is a space-saving four-pen plotter. It's designed to provide professional-quality output for drafting, surveying, business and other applications. The plotter produces four-color drawings in custom sizes on paper, mylar or vellum. It accepts data from either a standard EIA RS-232C or 20 mA current loop data source and can be operated on-line or in a timesharing environment. The CPS-16 features up to 172 firmware-generated characters containing upper/lowercase letters, positive paper feed, circular buffer memory and protocol for detection and correction of data transmission errors. Prices start at $10,900.

Houston Instrument, One Houston Square, Austin, TX



Houston Instrument's CPS-16 plotter.

78753. Reader Service number 498.

Disk Subsystem

The MS-800C disk subsystem is compatible with the Heath/Zenith-89, Apple II, TRS-80 Model II and all S-100-based units. The subsystem includes case, power supply, fan, cables and a choice of four different drive configurations: one single-sided drive, $1050; two single-sided drives, $1595; one double-sided drive, $1395; and two double-sided drives, $2095.

Matchless Systems, 18444 South Broadway, Gardena, CA 90248. Reader Service number 494.

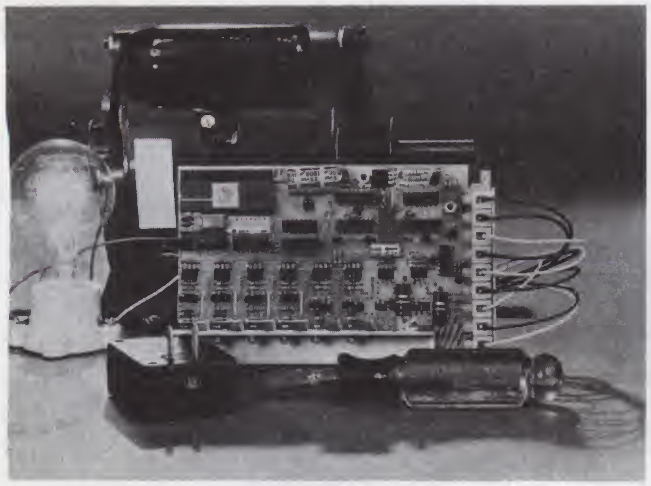
Distributed Control Micro

This new single board computer is configured as a remote terminal unit (RTU) for distributed control and remote data acquisition applications. The compact module includes a 6801 microprocessor, eight 12-bit analog inputs, eight-bit analog output, eight ac or dc inputs or outputs, serial I/O, watch-dog timer and power supply. The 6801 is programmed with C-net, a communications protocol that allows up to 31 RTUs in a net with one or more master computers. C-net permits the systematic transfer of commands, data and alarms between the masters and RTUs. Priced at $199.

Wintek Corp., 1801 South St., Lafayette, IN 47904. Reader Service number 487.

Memory Expansion For HP-9845

Eventide Clockworks Inc., 265 West 54th St., New York, NY 10019, offers a 512K byte memory board for Hewlett-Packard 9845-series microcomputers. The 9845s can accommodate up to three of these boards, providing a random access memory of 1.5 megabytes. A built-in hardware security system uses electronically embedded code which can be read by the proprietary program. If the code is missing or incorrect, the



Wintek's single board computer RTU.

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TEACHER'S AID is the grade management system you've been waiting for. Its many features mean that you can be free from the drudgery of hours of record keeping and grade reporting. Now you can devote more time to the pleasures of teaching.

TEACHER'S AID is easy to use, menu driven and features—

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(16K with 2040 or 4040 disk)

TEACHER'S AID will be ready soon on the Atari 800 and TRS-80 Model I or Model III.

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FOR ONLY $129.95 Learn Computing From The Ground Up

Build a Computer kit that grows with you, and can expand to 64k RAM, Microsoft BASIC, Text Editor/Assembler, Word Processor, Floppy Disks and more.

1. Plug in Netronic's Hex Keypad/Display
2. Add Level B to convert to S100
3. Add 4k RAM
4. Plug in Level E here; accepts Microsoft, BASIC or Editor/Assembler in ROM
5. Add two S100 boards
6. Add you own custom circuits (prototyping area)
7. Connect terminal

EXPLORER/85

Here's the low cost way to learn the fundamentals of computing, the all-important basics you'll need more and more as you advance in computer skills. For just $129.95 you get the advanced-design Explorer/85 motherboard, with all the features you need to learn how to write and use programs. And it can grow into a system that is a match for any personal computer on the market. Look at these features: 8085 *Central Processing Unit*, the microprocessor "heart" of the Explorer/85. (Join the millions who will buy and use the 8080/8085 this year alone!) . . . *Four 8-bit plus one 6-bit input/output ports* from which you can input and output your programs, as well as control exterior switches, relays, lights, etc. . . a cassette interface that lets you store and reload programs you've learned to write . . . *deluxe 2,000 byte operating system/monitor* makes it easy to learn computing in several important ways: • It allows simpler, faster writing and entering of programs • It permits access by you to all parts of the system so you can check on the status of any point in the program • It allows tracing each program step by step, with provision for displaying all the contents of the CPU (registers, flags, etc.) • . . . and it does much more!

You get all this in the starting level (Level A) of the Explorer/85 for only **$129.95.** Incredible! To use, just plug in your 8VDC power supply and terminal or keyboard/display — if you don't have them, see our special offers below.

☐ Level A computer kit (Terminal Version) . . . **$129.95** plus $3 P&I.*

☐ Level A kit (Hex Keypad/Display Version) . . . **$129.95** plus $3 P&I.*

LEVEL B — This "building block" converts the motherboard into a two-slot S100 bus (industry standard) computer. Now you can plug in any of the hundreds of S100 cards available.

☐ Level B kit . . . **$49.95** plus $2 P&I.*

☐ S100 bus connectors (two required) . . . **$4.85** each, postpaid.

LEVEL C — Add still more computing power; this "building block" mounts directly on the motherboard and expands the S100 bus to six slots.

☐ Level C kit . . . **$39.95** plus $2 P&I.*

☐ S100 bus connectors (five required) . . . **$4.85** each, postpaid.

LEVEL D — When you reach the point in learning that requires more memory, we offer two choices: either add 4k of a memory directly on the motherboard, or add 16k to 64k of memory by means of a single S100 card, our famous "JAWS."

Level D kit: (CHECK ONE) . . . ☐ 4k on-board . . . **$49.95** plus $2 P&I*; ☐ 16k S100 "JAWS"; . . . **$149.95** plus $2 P&I*; ☐ 32k S100 "JAWS" . . . **$199.95** plus $2 P&I*; ☐ 48k S100 "JAWS" . . . **$249.95** plus $2 P&I*; ☐ 64k S100 "JAWS" . . . **$299.95** plus $2 P&I*.

LEVEL E — An important "building block;" it activates the 8k ROM/EPROM space on the motherboard. Now just plug in our 8k Microsoft BASIC or your own custom programs.

☐ Level E kit . . . **$5.95** plus 50¢ P&I.*

Microsoft BASIC — It's the language that allows you to talk English to your computer! It is available three ways:

☐ 8k cassette version of Microsoft BASIC: (requires Level B and 12k of RAM minimum; we suggest a 16k S100 "JAWS" — see above) . . . **$64.95** postpaid.

☐ 8k ROM version of Microsoft BASIC: (requires Level B & Level E and 4k RAM; just plug into your Level E sockets. We suggest either the 4k Level D RAM expansion or a 16k S100 "JAWS.") . . . **$99.95** plus $2 P&I.*

☐ Disk version of Microsoft BASIC: (requires Level B, 32k of RAM, floppy disk controller, 8" floppy disk drive) . . . **$325** postpaid.

TEXT EDITOR/ASSEMBLER — The editor/assembler is a software tool (a program) designed to simplify the task of writing programs. As your programs become longer and more complex, the assembler can save you many hours of programming time. This software includes an editor program that enters the programs you write, makes changes, and saves the programs on cassettes. The assembler performs the clerical task of translating symbolic code into the computer-readable object code. The editor/assembler program is available either in cassette or a ROM version.

☐ Editor/Assembler (Cassette version: requires Level "B" and 8k (min.) of RAM — we suggest 16k "JAWS" — see above) . . . **$59.95** plus $2 P&I.*

☐ Editor/Assembler (ROM version, supplied on an S100 card; requires Level B and 4k RAM (min.) — we suggest either Level D or 16k "JAWS") . . . **$99.95** plus $2 P&I.*

8" FLOPPY DISK — A remarkable "building block." Add our 8" floppy disk when you need faster operation, more convenient program storage, perhaps a business application, and access to the literally thousands of programs and program languages available today. You simply plug them into your Explorer/85 disk system — it accepts all IBM-formatted CP/M® programs.

☐ 8" Floppy Disk Drive . . . **$499.95** plus $12 P&I.*

☐ Floppy Controller Card . . . **$199.95** plus $2 P&I.*

☐ Disk Drive Cabinet & Power Supply . . . **$69.95** plus $3 P&I.*

☐ Drive Cables (set up for two drives) . . . **$25.00** plus $1.50 P&I.*

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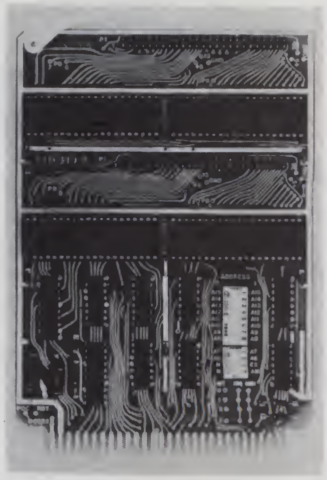
user will not be able to run the program.

A programmer's utility package ROM can be ordered with the board to enhance programming productivity. It includes XREF, MAP, CHANGE, FIND, DUMP ALPHA and MSI commands. The WMAZ-4 board costs $6500; the utility ROM is $700 extra. Reader Service number 492.

Limited Distance Modem

International Data Sciences, Inc., 7 Wellington Road, Lincoln, RI 02865, has introduced the Model 6200 Limited Distance Modem. The modem is designed for asynchronous operation over private two- and four-wire non-loaded metallic conductors at speeds up to 19,200 bps. It can be used in both point-to-point and multidrop network configurations and is ideally suited for local data distribution up to nine miles. The modem employs a baseband modulation scheme that varies the voltages of the transmit signal on a balanced line, therefore requiring dc continuity. A built-in diagnostic capability helps verify system performance and isolate equipment failures in the communications link. The IDS Model 6200 is priced at $250. Reader Service number 484.

STD Bus Board



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Forethought Products, 87070 Dukhobar Road, Eugene, OR 97402. Reader Service number 495.

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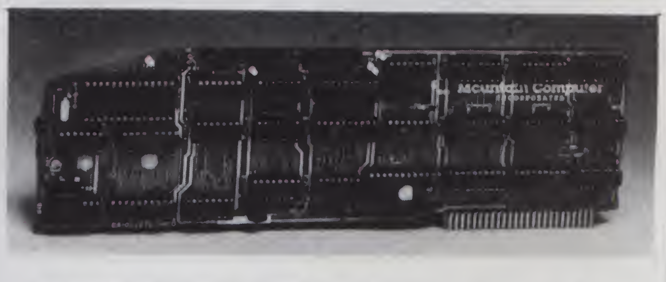

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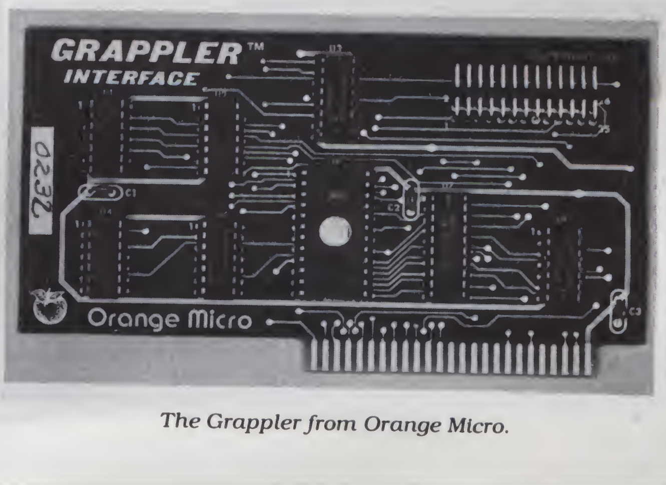
Orange Micro, Inc., 3150 E. LaPalma #1, Anaheim, CA 92806. Reader Service number 496.



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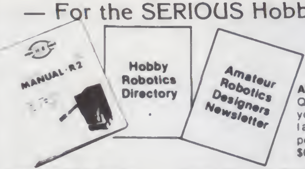

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CLUB NOTES

Portland Computer Society

The Portland Computer Society meets the third Saturday of each month at the Far West Federal Savings Community Meeting Room, 4770 SW 76, Portland, OR (503-292-4412).

Connecticut CP/M User's Group

The purpose of the Connecticut CP/M user's group is to bring CP/M users together to discuss CP/M-based hardware and software. The group meets the last Monday of each month. For more information contact The Wordsmith Network, 110 Day Hill Rd., Windsor, CT 06095 (203-683-2427).

Heath User's Group

Heathkit hobbyists have formed a local Heath user's group in Charlotte, NC. For details on the monthly meetings, contact Jim Simpson, HUG Charlotte, 2721 Picardy Place, Charlotte, NC (704-374-6997 or 375-1581).

OSI User's Group

The OSI user's group of southern Ontario will meet December 5, 1981, at McMaster University, Hamilton, Ontario. For further information contact Dr. N. Solntseff or Mr. C. Bryce, Unit for Computer Science, McMaster University, Hamilton, Ontario L8S 4K1 (416-525-9140 ext. 4689 or 2065).

South Florida User's Groups

The Ft. Lauderdale section of the South Florida Computer Group meets at the Social Annex, Holiday Park, Ft. Lauderdale, FL, the second Monday of each month at 8 PM. For more information contact Bob Haskins, 305-922-0955.

The Miami section meets the third Tuesday of each month at 8 PM at 240 NW 203 Terrace, Miami, FL. For further information contact Jerry Lofstead, 305-653-0669.

IBM Personal Computer User's Group

The Philadelphia Area IBM Personal Computer User's Group is being formed to stimulate communication among its members and members of other IBM microcomputer user's groups. A monthly newsletter will be published and group activities will be sponsored. Interested persons should contact Craig W. Uthe, 4101 Spruce St., Apt. 311, Philadelphia, PA 19104 (215-387-8208).

Osborne User's Group

The Osborne Business Software User's Group was recently formed to promote the use of Osborne/McGraw-Hill software. Membership in the group costs $10 a year and includes a subscription to the group newsletter, bug reports/fixes and access to additional compatible business software on eight-inch disks.

For further information contact John G. Ellis, Osborne Business Software User's Group, 2256 Main St., Suite 11, Otay, CA 92011 (714-423-0538).

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For sale: CT64 terminal $130, digital cassette drive $30, WW 6800 CPU brd (4K PROM w/listing, 2 PIA, 2 ACIA, 1K RAM) $30. John Aggers, 15742 Heywood Way, Apple Valley, MN 55124. 612-432-4483.

For sale: DEC VT103AA terminal, LSI-11/2, 96K memory 1 Megabyte dual floppy disk drive—RX02, RT11 Op. Sys. KED Text Editor, complete system, like new $8600. Howard C. Cooper, 630 N. 200 E., Kaysville, UT 84037. 801-766-1071 or 801-526-2601.

For sale: North Star Horizon 2. Includes two 5-inch double density disks, 48K RAM, sound gen. board, software, documentation and Hazeltine 1500 24 × 80 super terminal. Complete system: $2900. Duane Brummel, Rt. 2, Brookyn, WI 53521. 608-835-7554.

For sale: ASR 33 teletype with stand and manuals. Excellent condition. $250 plus shipping. John Dobiac, 101 S. Fox Rd., Sterling, VA 22170. 703-430-6950 after 6 PM.

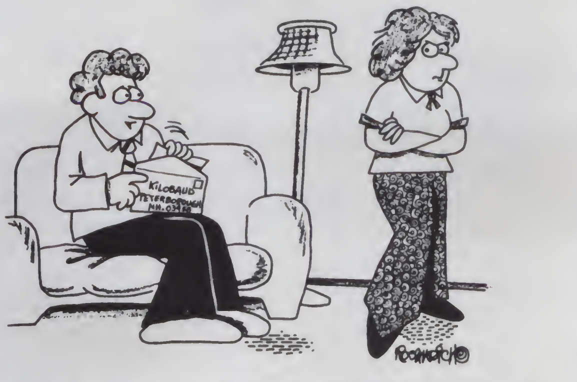
For sale: 2114L2 memory chips, new—never used. All or part, $2.65 each. R. Van Cleave, 256 S. Tucson Circle, Aurora, CO 80012. 303-340-2955.

For sale: Diablo 1640KSR daisywheel printers, one new and one used, $2150 and $1950. TRS-80 printer III, used, $1200. San Jose, CA, call Chris 415-494-4557.

MICRO QUIZ

(from page 23)

Answer: 1, 2, 4, 5 and 3.
Array A has values 5, 3, 4, 2, 1.
Array R has values 3, 5, 2, 4, 1.
$R(A(1)) = R(5) = 1$
$R(A(2)) = R(3) = 2$
$R(A(3)) = R(4) = 4$
$R(A(4)) = R(2) = 5$
$R(A(5)) = R(1) = 3$



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Bay area's newest computer software store. Featuring Instant Software for the TRS-80, Apple, magazines, books. **Shaver Radio, 1378 S. Bascom Ave., San Jose, CA 95128. 998-1103.**

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Sales, service and leasing for Apple, SD systems, Altos, Atari, Mountain Computer, Intersystems, Epson, Anadex and Paper Tiger. Software, books, and magazines. Systems consulting. Mail order. **H.I.S. Computermation, Inc., 1295 Cypress Ave., Melbourne, FL. 254-9399.**

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Computer hardware: North Star, Zenith, Atari, CBM/PET, Qume, Epson and others. Software: EduWare, Professional Software, Zenith, North Star, Programma, Personal Software and others. Factory trained service dept. Books, magazines, etc. Full product line on display. **Comtek Electronics, Inc., Rt. 46 West, Lodi, NJ. 472-2440.**

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Discount software—up to 25% off business, utility, recreational, educational and home programs. Apple, Atari, TRS-80 and PET. Atari computers always on sale. **Software City, 111 Grand Ave., River Edge, NJ 07661.**

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Retail book store featuring the Disassembled Handbook for TRS-80 Volumes 1, 2, 3. English, German & French language editions. 9 AM–5 PM weekdays. Come and visit us. **Richcraft Computer Book Store, 1 Wahmeda Ave., Chautauqua, NY 14722. 753-2654.**

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New and experienced computers, printers, modems. Software exchange. VHS video equip., blank tapes, rated movies. List includes (send SASE): PET, SSB, TRS-80, SWTP, Panasonic, VCX. **Video Computer Center, Box 1285-408, W. Liberty St., Rome, NY 13440. 336-0266.**

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NEW SOFTWARE

Edited by Linda Stephenson

Real Estate Software
Apple Business Accounting
CBASIC-2 Screen Handler
H8 Speed-up

Real Estate Office Management

A CP/M software package that provides accounting and management information for real estate brokerage firms is available from Reality Automation, Inc., 221 North Lois, La Habra, CA 90631. It can handle one or more offices with one or more profit centers. The system includes a general ledger with profit and loss statements, balance sheets, trial balances and transaction registers. A chart of accounts developed by the National Association of Realtors is included, although the user can modify it or install his/her own chart of accounts.

The system permits office or division budgeting, and monthly, year-to-date and operating statement comparisons. Future cash flow estimates can be projected through the year-to-date budget. Accounts payable includes a checkwriter. A check can be entered once and will print monthly checks until removed. Price is $350. Reader Service number 464.

Apple Tree

First Edition is a computer conferencing package with general database and electronic mail features. Users enter messages and retrieve them via regular phone lines using a 48K Apple computer or terminal, disk drive and modem. Each new message is attached to others already in the database, allowing users to organize a conference tree of messages—any one of which can grow into a new conference or subconference. This tree structure makes it easier to find specific information and to enter information in the most appropriate part of the database.

Messages can be private or public. Seven different levels of password protection operate on the same system. Passwords are easy to change. Price is $95 with documentation.

Communitree Group, 470 Castro St., Suite 207-3002, San Fancisco, CA 94114. Reader Service number 466.

Business Accounting For the Apple

The GOCI Business Accounting package performs all accounting functions for general business applications. The package consists of nine interactive modules: General Ledger, A/R, A/P, Order Processing, Inventory Control, Fixed Assets, Payroll, Disbursements and Banking. It keeps up to 7500 inventory items up-to-date, issues POs and BOs, physical count lists with or without quantities, markup and profit data, returned goods memos and up to 900 services. In handles up to 2500 receivables, with selective customer service charges, variable discounts on any item, credit checking, automatic monthly billing, sales territory control and referral code. It allows for 2500 payables, and monitors cash requirements to vendors. All modules post automatically to the G/L using standard accounting practices with audit trails provided. Price is $1500.

GOCI Software, 9524 Briar Road, Bloomington, MN 55437. Reader Service number 470.

Data Security

An operating system for multi-user computer networks, offered by Digital Research, PO Box 579, Pacific Grove, CA 93950, features record and file locking and optional password protection. MP/M II can manage up to 400K bytes of random access memory. It includes utilities previously available only as options, such as a relocatable macroassembler, a linker with overlay facilities and a program library management utility. MP/M files are completely compatible with CP/M files. MP/M II comes on standard-format IBM single-density 8-inch floppy disk, priced at $450. Reader Service number 474.

MP/M II is a multi-user, multitasking operating system from Digital Research.

CBASIC-2 Screen Handler

Screenmaster is a screen-handler module provided in source code for inclusion in CBASIC-2 programs requiring full-screen or multi-screen input with automatic validation. The programmer has access before and after each input, and at submit time. CBASIC-2 code can be inserted to edit or control the program, overriding Screenmaster editing if necessary. The programmer and, optionally, the terminal user, have commands: GOTO (field) n, BACK/FORWARD n (fields), NEXT/PRIOR (screen), SUBMIT and ABORT. The output of Screenmaster is an in-memory array of user responses for further use by the programmer. Price is $195.

Marketing Essentials, Inc., 161 West 75th St., New York, NY 10023. Reader Service number 471.

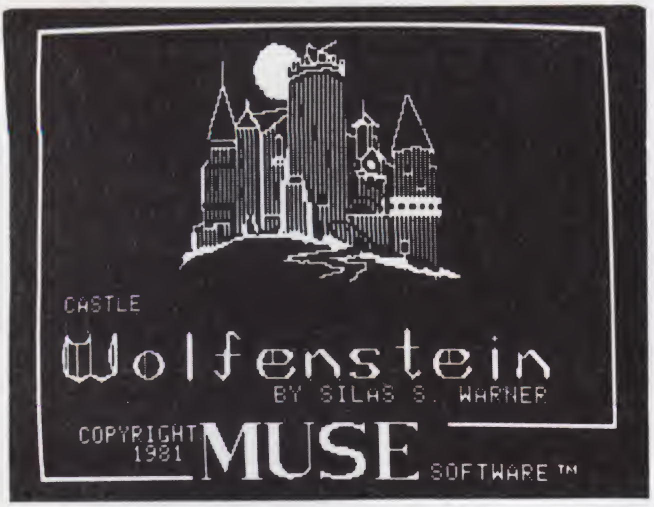
Flexible Operating System

PCD Systems, Inc., PO Box 143, Penn Yan, NY 14527, is now offering the UCSD P-system version IV.0 operating system, which lets users run applications programs written for one microcomputer on another—often without recompilation. The version IV.0 features the same operating system and utilities for a number of microprocessors, including the 8080, 8085, Z-8, Z-80, 6502, 6800, 6809 and the range of new 16-bit micros. It is fully supported to run on the TRS-80 Model II and Digital Equipment Corporation's LSI-11. The package includes the complete operating system for microcomputers (with the user's choice of Pascal, BASIC and FORTRAN compilers), a file handler, interpreter, screen and character editors, a macro assembler, linker and documentation. Price is $550 for FORTRAN or Pascal compilers, $450 for BASIC. Reader Service number 468.

An Adventure on the Apple

Muse Software, 330 N. Charles St., Baltimore, MD 21201, has introduced Castle Wolfenstein. This action-adventure game puts the player in the role of an Allied soldier in World War II. The castle itself is a magnificent Old World fortress occupied by the army of the Reich and converted into battlefront headquarters. The player, who has been captured and brought to Castle Wolfenstein for interrogation, is secretly slipped a loaded pistol by a dying cellmate. The player then assumes the game challenge: to find the Nazi war plans hidden in the castle and to escape.

The castle requires fast thinking and quick manual response. Castle Wolfenstein runs on an Apple II with 48K bytes of memory and one disk drive. Price is $29.95. Reader Service number 480.



You'll need quick thinking and good reflexes to meet the challenge of Castle Wolfenstein.

Speed Up Your H8 Programs

Interactive Microware, Inc., PO Box 771, State College, PA 16801, offers their BASEX interactive compiler and loader programs on cassette for Heath H8 microcomputers. BASEX is an intermediate-level language that combines features of BASIC and executable machine-language code. BASEX programs run up to 10 times faster than similar BASIC programs, and program overhead is only 2K bytes for the execution routines. Price is $33. Reader Service number 465.

Solar Hot Water Program

Sunheat1 can plan and evaluate a variety of solar hot water systems. It will estimate the amount of energy available with different types of solar collectors and heat exchangers and different preheat and hot-water tank sizes. Sunheat1 can also be used to find the optimum tilt angle for the collector, the best type of collector and best heat transfer fluid. The program is customized for each user's specific location, with average temperature, cloudiness and available solar energy data. Typi-

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HOW TO BECOME A SUCCESSFUL COMPUTER CONSULTANT **$28.**
by Leslie Nelson, 2nd revised edition, Jan. 1981

Independent consultants are becoming a vitally important factor in the microcomputer field, filling the gap between the computer vendors and commercial/industrial users. The rewards of the consultant can be high: freedom, more satisfying work and doubled or tripled income. **HOW TO BECOME A SUCCESSFUL COMPUTER CONSULTANT** provides comprehensive background information and step-by-step directions for those interested to explore this lucrative field.

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by B. J. Korites, 3rd edition, June 1980

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cal hot water use can be selected, or users can enter their own values. Sunheat1 is available for either the TRS-80 Model I Level II or the Apple II+, on disk or cassette. Price is $19.

Solartek, PO Box 298, Guilderland, NY 12084. Reader Service number 469.

Medical Package for The Apple

Medical Office Management II is designed to manage the physician's appointments, private patient billing, third party claim form preparation, diagnostic and treatment records, patient report preparation, mailing lists, referral letters and general word processing.

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Charles Mann & Associates, 7594 San Remo Trail, Yucca Valley, CA 92284. Reader Service number 473.

Sophisticated Apple Analysis

SMART is a comprehensive, integrated system for institutional money managers and sophisticated investors. The system provides capabilities for retrieving, storing, graphing and analyzing securities and economic data. A portfolio module maintains and reports data and transactions for securities portfolios. Users of the system can automatically access data from one or more remote databases and prepare graphics displays in various formats. Graphing options include open-high-low-close charts, volume histograms, line charts and point plots. Graphs can be full-screen or independent split windows. Analytic tools include moving averages, exponential smoothing, momentum, trend lines and user-defined formulas. System requirements include a 48K Apple II+ computer, two disk drives, modem, monitor and printer.

Software Resources, Inc., 186 Alewife Brook Parkway, Suite 310, Cambridge, MA 02138. Reader Service number 479.

Financial Modeling System

Plan80 is a modeling system for microcomputers that interactively produces bar charts and line graphs or tables to let the user project sales, analyze cash flow and build budgets. The user enters row and column definitions, data assumptions and calculation statements using any familiar editor or word processor. Assumptions can be changed interactively and the results recalculated at any time. Any part of one model can be incorporated into another. The user can compute functions such as depreciation, present value and internal rate of return. Plan80 is available for Apple, CP/M and UCSD systems. Price is $295.

Business Planning Systems, 2 North State St., Dover, DE 19901. Reader Service number 472.

Troubleshooting North Star

Software tools that aid in the diagnosis of North Star hardware and/or software problems are available from Valley Forge Software Group, 406 West DeKalb Pike, King of Prussia, PA 19406. Included are a full memory test (with Grey codes) and other stepped cycles to help isolate transient memory failure. A disk exerciser aids in alignment tests and functional operation testing. A serial port testing routine checks operation of ports set up in a loop-back configuration. The most powerful tool is the on-line, interrupt-driven software-debugging system. This module provides review and modification of memory, hardware registers and hardware ports, with multiple breakpoint addresses. The debugger resides in memory with the North Star DOS and is capable of single-step execution of any 8080-based code. License per computer is $75. Reader Service number 476.

Disk Speed Measurement for the TRS-80

RPM measures the rotational speed and variation of disk drives on the TRS-80 Models I and III. Rotational speed errors are a common cause of problems, and variations in speed can cause intermittent, hard-to-detect errors. Readouts are given in real time as numbers, percents, words and graphs. RPM automatically shows speed ranges, and can recover from severe errors without a system reset. Price is $24.95.

Prosoft, Box 839, North Hollywood, CA 91603. Reader Service number 475.

Hands-On Learning

Block Shapes for Applesoft or Assembly contains programs to create and animate all types of shapes, such as vector shapes, block shapes, HPLOT shapes, text file shapes, data array shapes, and so on. This package is designed to help you learn more about graphics as you explore its possibilities. Most animation routines are in machine language, and the source codes for these routines are included. All source-code files are thoroughly explained and unprotected, and the machine-language routines are also unprotected. Cost is $99.95, on disks with documentation.

Avant-Garde Creations, PO Box 30160, Eugene, OR 97403. Reader Service number 477.

Word Processing Utility for Sorcerer

Roger Hagan Associates, 1019 Belmont Place East, Seattle, WA 98102, has released a utility program for use with the Exidy Sorcerer Word Processing System. WSORT is a high-speed Z-80 sorting routine. The sort is menu-driven, and it offers a choice of sort parameters. Any part or all of a file in memory can be sorted. WSORT turns the Exidy Word Processor Pac into a fast and convenient mailing list, bibliography, abstract, client file or other database management system. The program, with manual, costs $47.50. Reader Service number 478.

Software for Costing and Financial Analysis

The Manufacturing Cost Estimate (MCE) system and the Discounted Cash Flow (DCF) system are designed for manufacturing, engineering, consulting and analytical applications. MCE can be used to estimate fixed and variable manufacturing costs based on individual specifications for labor, utilities and raw materials. The program produces up-to-date cost listings for inclusion directly in reports. The DCF package aids managers and analysts in determining cash flow, rate of return and payback and escalation of income and individual costs. Separate interest rates can be used for borrowed and working capital, and tax losses and investment tax credits can be applied in the year incurred or carried forward.

The MCE and DCF packages run on the Apple II, TRS-80 and CP/M systems. MCE costs $75, and DCF is $125; both systems purchased together cost $149.

Centec Process Systems, Inc., Centec Building, 11260 Roger Bacon Drive, Reston, VA 22090. Reader Service number 481.

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BOOK REVIEWS

Edited by Eric Maloney

Real World Interfacing
Soul of a New Machine
CP/M Handbook (Two Views)
Real Time Programming
Software Debugging
Fifty BASIC Exercises

Interfacing Microcomputers to the Real World

Murray Sargent III and
Richard L. Shoemaker
Addison-Wesley Publishing Co., Inc.,
1981
Softbound, 288 pp., $14.50

A book review should not just praise a book or bury it, but should match the book to a compatible group of readers. That won't be easy this time.

Interfacing is immensely enjoyable, if you are into both hardware hacking and programming. But it's for neither the beginner nor for the expert. Even though both authors are from universities (Optical Science Department, U. of Arizona), the book is written in a sometimes painfully informal style. I still haven't figured out what waveform corresponds to their "bashed in sine wave" description.

Other informalities may offend some, like the advice to the puzzled reader to get a friend to explain things to him. You might expect the book to do that, but in many instances, it won't.

The authors assume that the reader has some background in both electronics and programming. At least that is the result of the presentation. While such elementary topics as the pin-outs and operating principles of TTL logic are discussed, the discussions are so superficial that a newcomer could not learn the subject from this book alone. I don't think that self-instruction for beginners was the intent of the book, and there are certainly enough references to additional reading like Don Lancaster's *TTL Cookbook* to back up my suspicions.

Beginners would also get lost by the fragmentation of subjects and the scrambled organization of the book. Seemingly everything you would ever want to know to hook up micros to external devices ranging from fiber optic transceivers to stepper motors is covered, including software written in assembly language, Pascal and FORTRAN. Obviously, with so many topics, nothing can be covered in any depth.

Now for the good part. While nothing is covered deeply, there is a wealth of information in the book, if you have the background to understand it. If you have done very much interfacing between computers and the real world, you won't need this book, but you might enjoy reading it anyway. If you are a hobbyist, experimenter or recently graduated engineer with not a whole lot of hands-on experience, this could be one of the most valuable book purchases you could make.

Sargent and Shoemaker have provided an ideal sourcebook, giving an overview of the world of interfacing. So many aspects are covered that it would be impossible to begin listing them here. If you are ready to get into hooking your computer up to the outside world, and want it to run your lawn sprinkler, air conditioning system or operate your ham station for you, this book would be a good place to get started. Provided you have that expert friend handy to help you out.

If *you* are the expert friend, you might buy this book to help you explain things to beginners. You might even find a topic or two that you need to brush up on, or never got into yourself. In any case, you will find this book both entertaining and informative. And awfully informal.

Ken Barbier
Borrego Springs, CA

The Soul of a New Machine

Tracy Kidder
Atlantic—Little, Brown
Hardcover, 291 pp., $12.95

Journalists have had a hard time finding heroes to write about during the last couple of decades. A hero by definition is larger than life, and life in the latter part of this century has become too overwhelming to let us accept the image of the lone conqueror. So writers have turned their attention to groups of ordinary people who collectively do something extraordinary. David Halberstam wrote *The Best and the Brightest*; Gay Talese wrote *The Kingdom and Power*, about *The New York Times*; and Tom Wolfe wrote *The Right Stuff*, about the American astronauts.

Now comes Tracy Kidder's *The Soul of a New Machine*, an inside look at how a group of 30 or so engineers—half of whom were right out of school—locked themselves in the basement at Data General for over a year to build the Eagle 32-bit supermini. The book presents further evidence that on America's technological frontier, the heroes have turned in their fancy spurs and silver six-shooters for soldering irons and microcode. Their work is as unspectacular as the gray walls surrounding them, and in the end the machine gets the glory. The satisfaction our computer cowboys get is personal, com-

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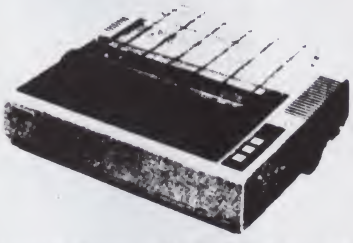

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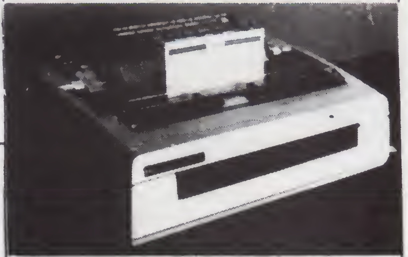

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ing primarily from the knowledge that somewhere in that hardware and software is their signature, some final product of their sweat and skill.

The book reads like a computer version of *The Magnificent Seven*. DG engineer Tom West puts together a team to come up with an answer to Digital Equipment Corp.'s VAX 32-bit mini. Some are young kids with peach fuzz on their faces; others are grizzled veterans of previous computer wars. They know it's going to be a dirty job—long days and nights, no sleep, no weekends off, low pay. But they're driven by the need to make something bigger than themselves.

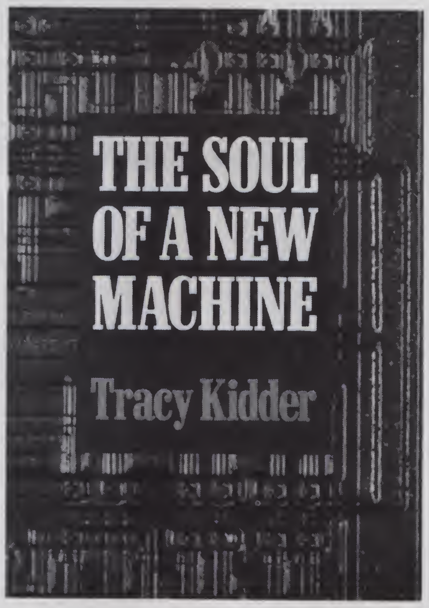
Kidder's account of the sacrifices made by the Eagle's creators will come as no revelation to anyone who has given himself up to a major project. But the average reader cannot help but be awed by the staggering amount of work and time necessary to build a major new computer. The volumes of paperwork, the rooms full of equipment, the endless detail, the excruciating debugging process—all conspire to show how much the computer transcends in complexity the abilities of any one person. While each of West's engineers responds to the task of building the Eagle in his own distinct way, the computer dominates. Only a few of the personalities Kidder describes project images that survive the machine by the book's end.

Despite the preeminence of the computer, Kidder succeeds in showing the human side of its invention and construction. We see engineers succumbing to the pressure and leaving the project; we see them playing Adventure at 4 AM; we see them fighting, yelling and laughing their way through the long arduous months. If the project is cold and logical, its workers are not; they use every trick and tool at their disposal to complete the best machine possible in the shortest amount of time, and their tool kit includes no small amount of luck and intuition. As Kidder points out, no matter what the corporate motivations for building the Eagle, "It seems more accurate to say that a group of engineers got excited about building a computer."

One of the most satisfying qualities of this book is the elegance Kidder lends it. *The Soul of a New Machine* is no kludge—Kidder is a professional wordsmith, and it shows on every page. He explains how a computer works, in simple and understandable terms, yet in a way that reveals something about the project and its engineers.

When discussing ROMs, for example, Kidder describes how West once jokingly called coworker Carl Alsing "a ROM-driven man." West then made up a song to the tune of "John Henry."

"West was always inventing catchy expressions, and 'ROM-driven' was Alsing's favorite," Kidder writes. "The contents of a ROM, once programmed into the chip, cannot be altered or erased; the information can only be 'read.' *ROM-driven*: it opens up the ancient question of predestination and free will. Later, Alsing would wonder how the phrase applied to his friend. So would West himself, apparently, for one day downstairs, during the Eagle project, he would ask—laughing his nervous-sounding laugh, not the hearty one of the pig roasts—'Doesn't anything around here happen by accident?' "



Ultimately, the book arrives at the Big Question: What motivated the members of the Eagle team to give so much to a machine, one that would no doubt be eclipsed by something better in a few years? Kidder anticipates the question near the end of the book, but the answers he suggests are nothing that would encourage a college freshman to take computer science courses. They involve such intangibles as self-fulfillment, a feeling of accomplishment, self-satisfaction. Rosemarie Seale, the team's secretary, perhaps summed it up best:

"The bottom line on this is that effort was done; it was done well, with very little help from the corporation, if any; a lot of people were allowed to grow; a lot of people were allowed to feel good about themselves—not a pat on the back—but deep-down good about themselves. I guess all of us were trying to prove something."

Eric Maloney
***Microcomputing* staff**

The CP/M Handbook With MP/M

Rodnay Zaks
Sybex, Berkeley, CA, 1980
Softbound, 336 pp., $14.95

When you spend over $200 for an operating system, you shouldn't have to spend another $15 to learn to use it. Unfortunately, the documentation of CP/M is both exhaustive and exhausting. Zaks has taken all the material, distilled the essence and presented it with style.

The first chapter can stand by itself. It is all that a nontechnical person needs to run a CP/M-based system. Zaks starts at square one and briefly describes all the parts of a computer system—even what a disk is and how it works. From there he goes on to explain running a program, writing to files and simple file manipulations such as opening, closing, renaming and erasing. He also covers reading the directory and printing a listing.

The second chapter goes a step deeper by describing inherent CP/M commands such as STAT, SAVE and REN (rename). It then deals with transient commands such as PIP, SYSGEN and MOVCPM. The treatment is not exhaustive, but it's sufficient for the first-time user. Tables and charts explain control characters and various combinations of commands.

The next two chapters alone are worth the price of this book. They describe PIP (peripheral interface program) and ED (text editor program). These chapters are useful for two entirely different reasons. PIP routines are commands that give CP/M much of its power, but they're difficult for both novice and veteran users to understand. Zaks leads you through them step by step. The ED program is described by Zaks as a minimal text editor—the nicest thing that I have heard it called. He suggests that you buy another text editor. However, he does go on to make the most of this program, and by the time I had finished the chapter, I was prepared to use ED.

In the next two chapters, Zaks describes the mechanics of CP/M including memory, disk maps and summaries of all the commands in versions 1.4 and 2.2 as well as MP/M. These are invaluable to a serious programmer. Once again they are present in Digital Research's documentation but are difficult to find.

The final two chapters are the icing on the cake. Zaks gives his own practical hints on the operating system. Even old hands will appreciate them.

I recommend *The CP/M Handbook* to everyone interested in CP/M, to everyone about to buy the system and to everyone who already has it and is either lost or thinks he knows it all. Fifteen dollars is a lot to spend for something that should have been supplied, but this book is worth every cent.

Bruce Evans
Pickering, Ontario

If the manuals supplied by Digital Research weren't confusing, this book would not be needed. Unfortunately, Rodnay Zaks continues in the footsteps of Digital Research with a book that does all it can to completely confuse the reader in Chapter 1.

Assuming that this book will be bought by either a prospective or an inexperienced user of CP/M, the reader will be lost before finishing page 6. Topics covered include two versions of CP/M, one of MP/M, Cromemco's CDOS, PIP, ED and BASIC. More confusion continues from page 7 to the end of the first chapter, with the author throwing everything at the reader from "How to Turn on the Cromemco" to WSU.COM and WSMSG.COM!

If the reader does manage to struggle through Chapter 1, he then enters the area of incomplete topic coverage and outright misinformation. (I have two pages of notes on errors included in this book.) Of course, the book has a lot of usable information, but a first-time user of CP/M is not going to know how to find it, and won't have any way of filtering the good data from the bad.

This is all the more disturbing because Zaks started out with the right idea in mind: set down a set of simple instructions for the nonprogramming user of CP/M. Why he then gets bogged down in the intricacies of PIP in the first chapter is beyond comprehension. This pattern is continued throughout the book. Some topics are covered in needless detail; others are totally ignored. To confuse the reader struggling through the useful data, there are continual references to too many versions of CP/M, and instructions for MP/M which should have been segregated into an appendix or another book altogether.

The microcomputer world certainly has a need for a CP/M handbook. This isn't it.

Ken Barbier
Borrego Springs, CA

Real Time Programming—Neglected Topics

Caxton C. Foster
Addison-Wesley Publishing Company, Inc., 1981
Softbound, 190 pp., $8.95

If I were teaching a class in interfacing, this would be my text.

If there is no class on interfacing, this can be your text.

Most of us in the home computer field did not perfect our skills under the auspices of the local state college. Digital electronics was learned from magazines, and interfacing was learned with soldering iron in hand. Just why a CMOS chip disintegrated before your eyes, or why that TTL chip output noise instead of a signal, were the kinds of things that there were no teachers around to tell you. What are pull-up resistors? What is the best combination of hardware and software?

Those of us still with it must have loved it, but are painfully aware of the fact that there is still a shortage of the kind of information that newcomers to the computer field need. A B.S. in Computer Science does not usually mean that the holder of same knows anything about digital design, or peripheral drivers or interfacing to the *real* world. Only this year have a few colleges started offering microprocessor computing degrees that address these topics. I don't know what they are using for classroom texts, but if most of the students had this book, they probably would be spending their money on parts, and gaining some real experience, instead of taking the course.

If you open to the back of the book first, you will be scared to death of what you see. The cure for that is to open to the front of the book. Take it in order, at your own speed, one concept at a time. This book was put together by a master. Don't ruin his good work by jumping the gun.

All that is required is a grade school knowledge of electricity, a bit of algebra and some familiarity with the fact that CPUs have registers and instruction sets that do the work in a computer. It doesn't matter what chip. The 6502 and the Z-80 are used for examples, and assembler codes for both are explained. Where it applies, each example is shown in both instruction sets.

When a component is used in a circuit, the component is explained in a separate block of text. New concepts are also explained this way. The examples of how to use these devices and techniques are taken right out of the real world. Where a knowledge of the mathematics involved is helpful, the equations are carefully explained. The chapters and topics have been arranged so that the math builds upon what has already been discussed. This lowers the possibility of biting off more than you can chew.

When you've finished the book, you should have a good working knowledge of how to go about hooking your computer up to the world. Though the book starts with simple interrupts and port addressing, it soon works up to ac and dc control, testing and measure, and digital communications. You won't be an expert without a lot of actual building experience, but you'll know how to go about working on the problems that confront you, whether you are building a robot or sending electronic mail.

Mr. Foster has created a masterpiece. I am, quite simply, flabbergasted.

Dennis Thurlow
Peterborough, NH

Software Debugging for Microcomputers

Robert C. Bruce
Reston Publishing Co., 1980
Hardcover, $17.95, paperback, $10.95

Many books describe how to write a structured program, but few have been written exclusively about debugging. *Software Debugging for Microcomputers* fills the gap.

The author describes how to write a flowchart, how to transform the flowchart into a BASIC program and how comments aid in the debugging process. He also gives guidelines for where and how many comments should be inserted in a program.

The book covers six debugging techniques, including something called "playing computer." This is a form of debugging that is done before a program is entered into the computer. The programmer places himself in the role of the computer and executes the program. This helps him find logical as well as syntactical errors.

One chapter covers the use of print statements as a debugging aid, while another introduces the technique of "forcing," where the programmer tries to execute every branch to ensure that the program handles all cases. Bruce admonishes that the input to the program be devised so that the output is as easy to verify as possible.

Chapter 6 covers block debugging, a useful technique when you're trying to debug large, segmented programs. Bruce introduces the concepts of a "stub" and a "driver."

Chapter 7 deals with a debugging technique called "snapshots," with which the programmer is able to see large volumes of debugging information in a manageable form.

Bruce also discusses the advantages of inserting sleeping debugging statements into a program. This saves much time when a program needs to be modified.

Patches are covered in chapter nine. Sometimes a programmer encounters a bug that he can't fix. When this occurs, some program lines are inserted to circumvent the error. This type of debugging should be done only as a last attempt at eliminating the error.

All the techniques are used when Bruce goes through the debugging of a program in the last chapter. The reader can see how each technique can be best used.

Bruce has done a good job explaining debugging. The techniques shown are easily used with other computer languages. *Software Debugging for Microcomputers* will make a welcome addition to any programmer's library.

Ronald Brandow
Troy, NY

Fifty BASIC Exercises

J. P. Lamoitier
Sybex
Softbound, 231 pp.

J. P. Lamoitier states that "the most effective way of learning a programming language is through actual practice," but

I doubt that any beginning level BASIC programmer will be able to practice using this book alone. *Fifty BASIC Exercises* introduces you to Armstrong numbers, Egyptian fractions and the Fibonnacci maximal algorithm, but it doesn't give you a reasonable explanation of nested loops. It dives into the use of subroutines in program examples without an adequate explanation of a subroutine or general methods to properly use them.

Lamoitier omits many important programming concepts such as the CLS command and the logical AND and logical OR functions. Arrays are covered briefly, but a more detailed explanation is needed before a novice programmer could use them.

The author states that "all of the programs in the book are written in Microsoft BASIC and will execute directly on a TRS-80. . . ." However, it is unclear which level of the TRS-80 he is referring to. For instance, Lamoitier states that there are only 26 string names available consisting of a letter of the alphabet coupled with the dollar sign. This would seem to indicate the Level I but the programs freely use features found only in Level II, such as the square and exponentiation functions.

This book does have some strong points. An outstanding effort is the directory program in Chapter 5, which demonstrates sorts in an interesting way with a well-documented example.

While any single volume can't be an encyclopedia, I would trade off casual mention of skewness and kurtosis for a definition of ASCII or the fact that DEFINT and DEFSTR exist. As a reference volume on BASIC it deserves consideration only if you already own two or three good books that concentrate on giving you the ability to understand the fundamentals of BASIC programming.

Allan S. Joffe
Dresher, PA

New and Noted

Build Your Own Z-80 Computer. By Steve Ciarcia. Byte Books/McGraw-Hill. Softbound, 332 pp., $15.95. The author of the popular "Ciarcia's Circuit Cellar" in *Byte* magazine tells you how to build your own Z-80 computer.

Computer Graphics. By David Chance. Tab Books. Softbound ($8.95) and hardbound ($15.95), 280 pp. With 29 programs for the TRS-80.

The 8085/SDK-85 (Hands-On): 54 Control Experiments. By Howard Boyet. ITM Publications. Softbound, 394 pp., $19.95. Presents "new areas, applications and topics of a more advanced nature not covered in volume 1."

Information Technology and Health Care: the Critical Issues. Karen Duncan, ed. AFIPS Press. Hardcover, 144 pp. Material derived from 1979 National Computer Conference Symposium on Issues in Health Care Computing.

Packet Radio. By Robert Rouleau and Ian Hodgson. Tab Books. Softbound ($11.95) and hardcover ($18.95), 304 pp. Book for both amateur radio fans and computerists on "principles and potentials of this innovative technique for high-speed, multi-user access to data resources."

Playing the Stock and Bond Markets with Your Personal Computer. By L. R. Schmeitz. Tab Books. Softbound ($9.95) and hardcover ($16.95), 308 pp. Stock selection, buy-sell decision-making, market evaluation.

The 16-Bit Microprocessor Handbook. Edited by Blacksburg Group. Group Technology, Ltd. Softbound, 350 pp., $14.95. From the Blacksburg Continuing Education Series. Covers 8086, Z8001/2, 68000, 9900, LSI-11, 16032; includes software benchmarks.

34 More Tested, Ready-to-Run Game Programs in BASIC. By Delton T. Horn. Tab Books. Softbound ($7.95) and hardcover ($12.95), 224 pp. "All kinds of fun things to do on a home computer!"

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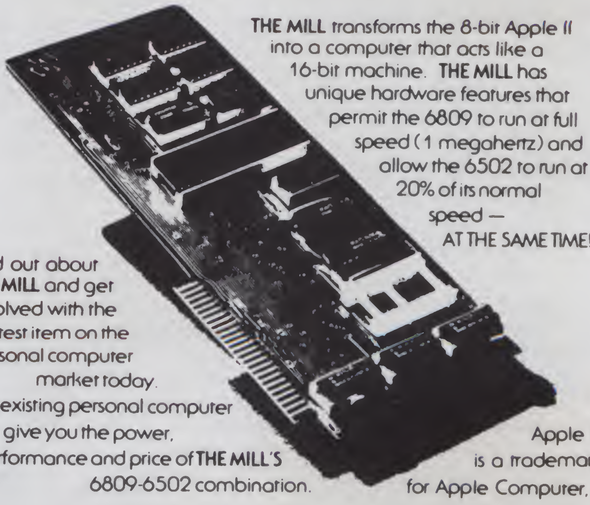

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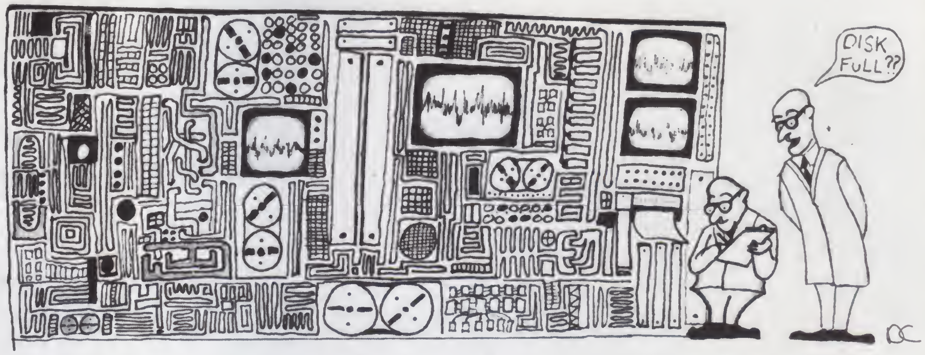

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Three Games for the Atari
SSG's General Ledger

Three Games for the Atari

One of my pet peeves about computer card games is that they don't often truly simulate play as it would occur in real life. This is particularly the case with blackjack. Much of the time a single player competes with the computer/dealer. The computer often deals from a single deck, uncut and poorly shuffled. Finally, you can't ask your fellow player for advice.

Casino Blackjack/Counter from Manhattan Software is an exception. It lets you play with one, two or four decks. (Many casinos use two or four decks to minimize the effectiveness of "counting.") The deck(s) is then shuffled and cut. The cut gives the dealer a random place to reshuffle, another technique used to discourage counting in some casinos. Play then begins; the computer acts as dealer and four other players. Your hand is displayed in the center of the screen.

You use the joystick to select the number of decks to be used, to place a bet, and to indicate what actions are to be taken during the deal. All the standard options are available to the player: insurance bets, splitting and doubling down. There is a 3-for-2 payoff for natural blackjack, and the dealer must hit on 16 and stand on 17, standard casino blackjack rules.

One of the ideas of this game is to help practice point counting. At any time when a bet is requested, you can select the option SEE POINT COUNT. The present count is displayed along with a suggested bet based on a simple system described in the documentation. If the current deck is nearly exhausted, a message warning that it may be necessary to reshuffle during the current hand is displayed.

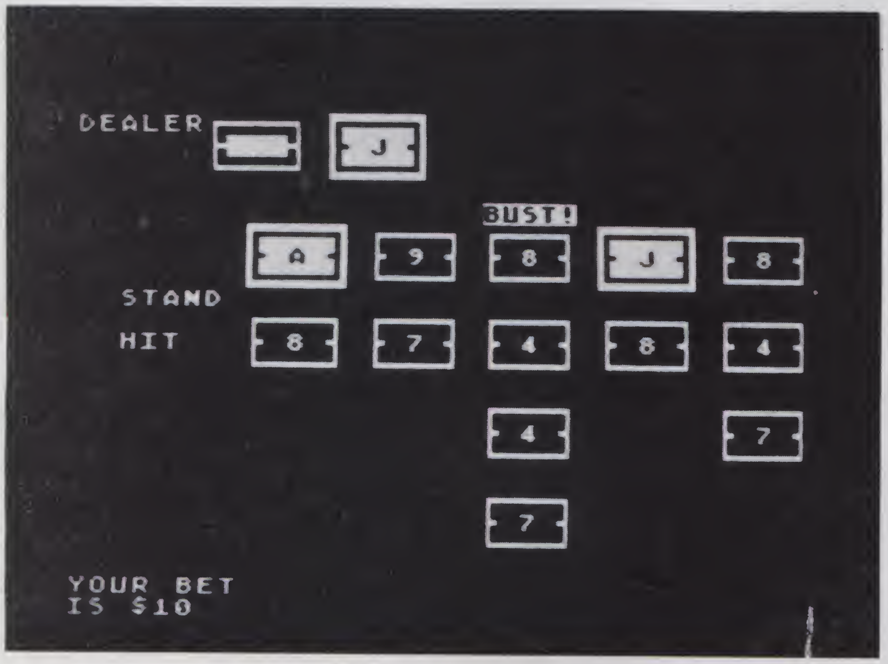

Photo 1. A scene from Casino Blackjack/Counter; I've just gone bust with 23. Note the options I had displayed at the left of the screen.

Casino Blackjack/Counter is a well written program and deserves a place in the library of anyone interested in playing blackjack.

Labyrinth Run looks simple. Indeed, the first portion of the simplest maze can be negotiated by even the most palsied hand. However, the slightest inattention results in a devastating crash, complete with loud embarrassing sounds of destruction.

Labyrinth Run is a fantastic game. The object, of course, is to get a runner through a maze in the shortest possible time. This simple goal is complicated by several factors. First, the runner moves rather quickly. Second, the mazes are cunningly designed with deceptive, easy stretches leading into tricky ones. Frustrations built up from many crashes then result in still more crashes after passing through the difficult section.

Labyrinth Run has three separate mazes, three levels of play, and a very interesting option, revolving doors.

All three mazes are designed to make you crash into the walls rather than to be difficult to solve. The first two involve the usual 90 degree turns. Number three has strange angles and is virtually impossible to get through except when playing at the highest skill level, which allows diagonal motion. Unfortunately, only the lowest skill level, novice, allows you to continue after a crash (though with a time penalty). Thus, the slightest error or lapse of vigilance results in sudden death for the runner.

After developing a little confidence with one of the mazes, it's fun to try the option, revolving doors. Toward the end of the maze there appear a pair of moving walls that open and close the path one must take to reach the end of the maze. It requires a combination of luck, good timing and a steady hand to get through.

Finally, here and there in each of the mazes are openings just wide enough for the runner to pass through. These pro-

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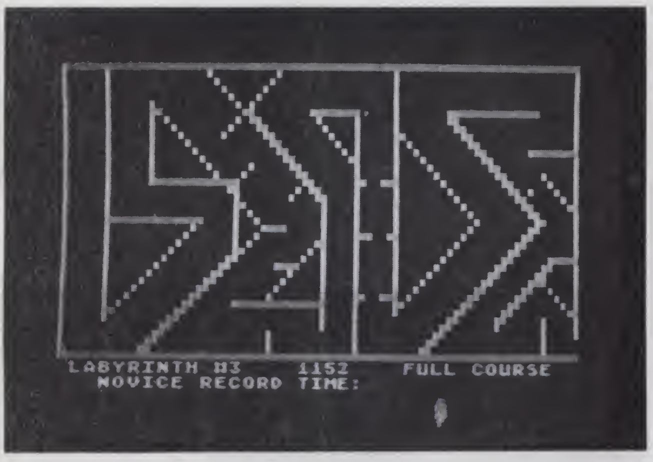

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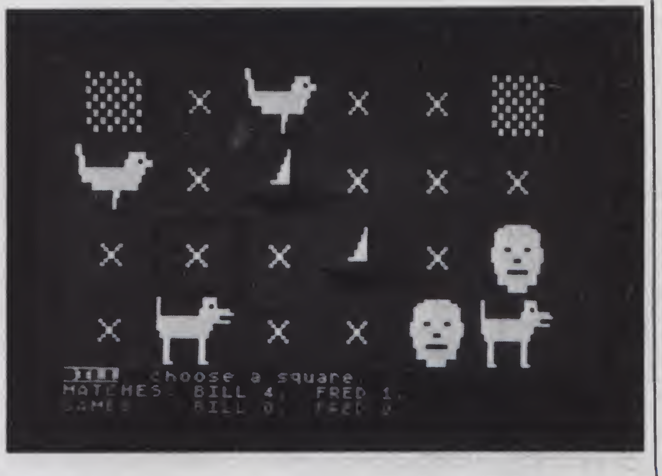
Photo 2. Course 3 of Labyrinth Run. The "runner" is at the far right of the screen just above center.



```
     choose a square.
MATCHES:  BILL 4,  FRED 1.
GAMES:    BILL 0,  FRED 0
```

Photo 3. A moment in Concentration when I'm actually beating my roommate.

vide time-saving shortcuts, but the problem is hitting the hole rather than the wall.

This is an excellent game, particularly for parties. It's fun to watch the times gradually increase as the supply of alcoholic potables decreases. (The determination of the players also seems to increase as their ability to coordinate eye and hand decreases.)

Concentration is a computerized version of the old television game. The object of the game is to match pairs of objects. Since this is a two-player game, the winner is the one who has made the most matches when all the objects have been revealed.

The game is simple to play. You move a box around the screen and when it is positioned on the square you want to reveal you press the fire button of your joystick. You then select a second square in the same way. If the revealed objects match, you get a point, the objects stay on the screen, and you get another chance. If they don't match, both are concealed again and your opponent tries his memory.

As you can see in Photo 3, this game makes excellent use of the Atari color graphics capability. There are a number of levels of play; the more objects there are to match (up to 12), the more difficult the game is. The game is fun for adults at the high end and is particularly good for young children at the lower levels. This is a game that can be a challenge at any age level.

William Colsher
Lisle, IL

Ordering Information

Casino Blackjack/Counter ($19.95)
24K, one joystick
Labyrinth Run ($14.95)
16K, one joystick
Concentration ($14.95)
16K/24K, two joysticks
Manhattan Software
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Structured Systems Group, Inc.'s General Ledger

The GFS Micro-Computers partnership was formed to do data processing for a small CPA firm. We needed a general ledger package that would be adaptable to different clients from different sized firms would be easy to learn and use and would have as much error detection ability as possible.

Since my teaching duties at Clarkson College include teaching an introductory course on computers and BASIC programming, I was elected to do most of the legwork. I chose General Ledger (Structured Systems Group, Inc., 5204 Claremont, Oakland, CA 94618), and I have never regretted it.

Although the introduction to the manual states that the General Ledger is written for CPA firms, it is so flexible that it can be adapted to any small business—if the business seeks help from its accountant in the initial setup.

The General Ledger is a menu-driven package written in CBASIC-2 to run on computers using CP/M, but it is no longer necessary to actually own the CBASIC language program. SSG has developed its own system including CBASIC and the programs written in CBASIC. This SSG system is called Itworks, probably, I suspect, because it does. Running SSG's General Ledger is as simple as inserting the proper disks and typing GL and the date, although the date will be requested at a later time if it is not entered to start the program.

Parameter System

General Ledger uses parameter files which must be entered at least once and may be changed as desired. These files contain basic information, such as company name, name of statements to be produced, size and type of paper and other report characteristics. The General Ledger will not run if parameter entry is not completed, and the program lets you know this in no uncertain terms by requiring entry at the first menu. One of the best features of SSG's General Ledger is its ability to detect errors, such as programs run out of sequence or lack of parameter files, and to refuse to go on until these errors are corrected.

Chart of Accounts

The General Ledger requires you to enter a chart of accounts, which is a list that assigns account numbers to the accounts which will be used. This step is crucial, because the output statements—Income Statement, Balance Sheet and Statement of Changes in Financial Position—are formatted by the numbering system chosen for the chart of accounts. It is at this point that a friendly accountant should be consulted, since the chart of accounts and numbering system will determine the usefulness of the statements both to the company and to outside users, such as bank loan officers.

As part of this initial setup, SSG has included the ability to generate sample statements that show the format of the balance sheet and income statement without you entering monetary amounts. The program generates the monetary amounts, but it must be noted that these sample statements will not balance, as the amounts are entered only to demonstrate what the statements will look like.

Transaction Entry

Once the chart of accounts is finished, it is possible to begin entering batches of transactions. Journal Entry is chosen from the menu, and a minimenu with a choice of two journals appears: General Journal for most transactions and Cash Disbursement for entries from a checkbook. The technique used is called form-filling, since the cursor moves to the proper screen position as required, and the spaces can easily be filled in and verified. Once again, SSG has designed superior error-catching programs, so the only mistakes that can be made are human—

miscopying data or misentering references. However, two running balances at the bottom of the screen make it possible to spot errors.

The next step is to print a proof sheet, which lets you make another comparison with the original documents. When you are satisfied with the journal proof, the journal batch is posted to a detail file. A trial balance and two different types of ledger reports can then be generated, but the period cannot be closed, and statements cannot be printed, until the detail file balances.

After the period is closed, the three statements may be generated, with the journal proof sheet, the trial balance and ledger reports acting as a hard-copy audit trail. Accountants will appreciate the audit trail, while management will appreciate the usable statements.

Other Features

There are other features which are useful in certain instances, such as multiple profit center and branch reporting. An example of a use of multiple profit centers would be to separate a retail store into departments; an example of branch reporting would be when a firm has more than one location and wants the income from these reported separately. Unfortunately, these options cannot be used simultaneously, but it is possible to adjust the chart of accounts to simulate either a multiple profit center or a branch.

A feature which is extremely important to the accountant is the Statement of Changes in Financial Position, which is required by Generally Accepted Accounting Principles along with the Balance Sheet and Income Statement. The Statement of Changes is difficult and time-consuming to develop manually, but the SSG General Ledger makes it simple, as it generates the entire statement within a matter of minutes.

Because of the batch transaction system used in the General Ledger, the posted detail file must be sorted by chart of account number, and the chart of accounts itself must also be sorted. SSG has included in the package a version of the QSORT, which does an efficient job of handling the necessary sorts.

Structured Systems Group offers a unique service called the Software Maintenance Plan. For a monthly fee, the user is entitled to updates as they are issued and to answers to questions which the user or the dealer cannot answer. The people on the SSG Hotline are cooperative and knowledgeable about their products.

Conclusions

I am pleased with the Structured Systems Group's General Ledger. It has done everything I could have wanted, and has never failed to impress me with its versatility. It is, however, necessary to comment on the questions of whether it is easy to use and easy to learn.

As with any computer program, this one is easy to use only after you have gone through the manual thoroughly and worked with the program. The manual could use some improvements in explanations and diagrams, as well as an index, but I am sure SSG will revise it when possible.

Meanwhile, the initial setup is the most involved part, and this must be done carefully, since the quality of the reports generated depends on the setup. As stated before, I recommend seeking the help of an accountant at this point, and when it comes time to close out the year—although this is for accounting purposes and not because the General Ledger requires it.

Once the chart of accounts is entered, the rest of the program runs well, is easy to learn, easy to use and comprehensive. All in all, the Structured Systems Group's General Ledger is a satisfactory package for business data processing.

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PERSPECTIVES

(continued from page 242)

well as any travel expenses related to attending the classes if such expenses were not reimbursed by his employer.

Documentation of all expenses will be required if E wishes to claim such items as employee business expenses. A letter by his employer may be required to justify the need and use of the computer as well as specimens of the work produced. Travel expenses can usually be documented by a mileage log or a similar instrument. Education expenses are usually deductible if they improve skills required by the present job, and do not qualify the individual for another job and are not taken to meet the minimum requirements for the present job.

Publications 508, 529 and 587 from the IRS can provide some additional information on employee business expenses.

Tax Preparation Expenses

The IRS allows a deduction to be made for any reasonable expenses related to the preparation of individual income taxes. If you purchase books, computer programs or use your computer for the maintenance and computation of income tax information, such expenses are deductible.

Ms. R is an executive with a large corporation and incurs a substantial amount of expenses relating to her job. She decides to purchase a microcomputer to help her maintain records on those expenses. In addition to the computer, she also purchased assorted software packages which will be used to assemble and calculate her taxes for the year.

The system costs $2500 and she figured that it would pay for itself in a few years because her accountant normally charges $1200 per year to assemble the information for her.

The IRS allows a deduction to be made for tax preparation expenses. Tax preparers typically charge anywhere from $20 to $500 for the preparation of individual income taxes. If a taxpayer elects to prepare his or her own taxes with the aid of a computer, such expenses are deductible if they are reasonable. There is no set formula, but common sense should dictate whether or not an expense is reasonable. Also note that if the computer is only used 10 percent of the time for tax purposes, only 10 percent of the expenses should be deducted.

Computer software and manuals for the preparation of taxes are generally fully deductible provided that it is within reason. A person preparing a short form will not need to spend $200 for preparation material, while a person with a business may easily spend $500.

Tax preparation expenses and/or fees are deductible only if you itemize deductions. Persons using the short form will not be eligible to deduct tax preparation expenses.

Investment Expenses

If a computer is used to maintain records on individual investments, the expenses are also deductible. Typical applications may include using the computer to monitor a stock portfolio or the financial status of income property. The same rules apply to investment expenses as tax preparation expenses.

Investment Credit

If you buy certain new or used tangible personal property (computer and peripheral devices) with a useful life of at least three years for use in your job or business, the equipment qualifies for a credit of up to 10 percent of the cost of the qualifying property (form 3468).

Ms. C purchased $5000 worth of computer equipment for her software company and she expects to use the system for at least seven years. The equipment will qualify for a 10 percent investment credit of $500. The tax credit will result in a reduction or refund of $500 to Ms. C.

The investment credit is based upon the expected life years of the qualifying property. A maximum credit is given for equipment with a life of seven years or more. For more details on computing investment credit, see IRS publication 572.

Capital Gains and Losses

A capital gain or loss is realized when you sell property that was held for trade or business.

Ms. C decided to sell one of her computers because the manufacturer went out of business and the computer was not supported by any local dealer. The computer cost her $2000 and she was only able to sell it for $200 because it was no longer in demand. She may deduct a loss of up to $1800 on the transaction if the machine was used in her business.

Different methods of calculating the loss would be used if the machine was held for more than one year and if any depreciation was claimed. Details on how to claim the loss are included on schedule D.

Depreciation

If you plan to deduct expenses from the use of computer equipment, such expenses must be "capitalized" over the life of the equipment. This is commonly referred to as a depreciation expense. A simple formula for computing depreciation is as follows: cost − salvage value ÷ life.

For example, if cost = $5000, salvage value = 0 and life = five years, then depreciation expense for year 1 = ($5000 − $0) ÷ 5 = $1000.

The example shows a straight line depreciation. There are several other methods used in calculating depreciation expenses. It is a fairly complex area and is beyond the scope of this article. If you qualify for a depreciation deduction for your computer equipment, consult an accountant or tax attorney for a determination of which method to use.

Tax Planning

If you are planning to purchase a computer and/or enter into a business which will use computers, some advance planning can save you significant amounts of money. In order to claim the deductions outlined in this article, you must be able to document all expenses as well as detail their use. Even if you are purchasing a computer strictly for hobby use, save all receipts because if you enter into a business later that year, you can deduct a percentage of the computer use.

If you plan to lease a computer system, make sure that the lessor elects to pass the investment tax credit to you; otherwise, you can lose up to 10 percent of the cost of the system.

For 1981, there have been several proposed changes in the tax laws which will provide more favorable tax treatment of equipment purchases. Once these laws have been enacted, the changes should be taken into account when determining depreciation and investment tax credits.□

References

West's Federal Taxation: Individual Income Taxes, Phillips & Hoffman, 1981 Edition, Prentice Hall.
1981 U.S. Master Tax Guide, Commerce Clearing House.
Internal Revenue Code, U.S. Government Printing Office.
Publication 17: Your Federal Income Tax, (an expanded instruction booklet for completing form 1040 free for the asking from the IRS).

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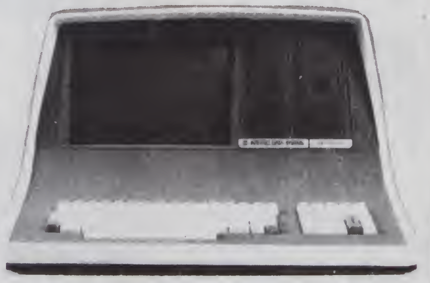

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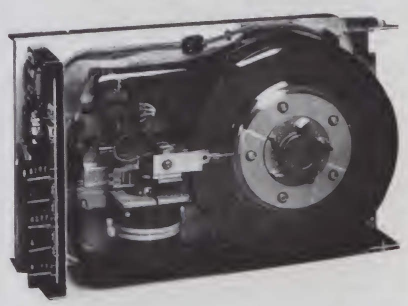

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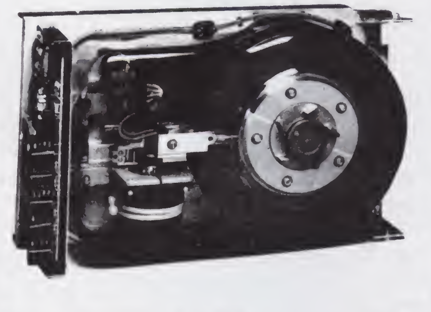

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By Hoy Quan

The IRS And You

Tax Guide For Micro Users

As we approach the end of the year, it is time to begin thinking about calculating our individual income taxes. Software vendors are promoting microcomputer income tax programs that promise quick and easy relief from the burden of doing our taxes. They may save us some time, but rarely do they save us any money. However, computers *can* save us money when it comes to income taxes.

Home computer owners will have invested anywhere from $300 to $30,000 in their systems. Such expenditures can have significant tax implications if you are careful in planning your purchases and documenting their use. The IRS offers very generous tax credits and deductions if you qualify.

Deductions are allowed for profits or losses from a business or profession, capital gains and losses, employee business expenses, tax preparation expenses and investment fees and expenses. If you use your computer for any of the activities listed above, you can qualify for deductions of part or all of the expenses relating to the use of your computer.

Profits or Losses From a Business or Profession

Schedule C is the form you fill out to document any profits or losses from a business or profession. If you provide any type of service, or engage in any type of sales activity which utilizes the computer, you can deduct those expenses from your income. A qualifying business does not have to be a full-time activity and may be operated from your place of residence (for example, consulting, producing software and selling computer equipment and supplies).

If you are operating the business on a part-time basis, any losses you incur can be deducted from income derived from other sources such as salary. Also note that if the business becomes very successful, all profits must be added to your income.

The IRS imposes strict rules on deducting losses from hobby activities, so you must substantiate the business nature of your activities if you plan to deduct losses from a computer business. The following criteria apply:

The manner in which the activity is operated. Is it conducted in a businesslike manner? Are there indications that a business actually exists (business license, cards, letterhead)?

The expertise of the owner. Is he/she qualified to conduct such a business?

The time and effort expended. Are business activities actually conducted and to what extent?

The relationship of profits earned to expenses and losses. Is revenue generated from the activity or is it operating at a total loss? If there are excessive losses, the business becomes questionable.

The financial status of the individual. Does he expect significant additional income from the activity?

Elements of personal pleasure or recreation. Is there a serious intent to conduct a business?

A general rule used by the IRS to determine whether or not the activity is a business is the profitability presumption. If the activity shows a profit in at least two out of five years, then the IRS bears the burden of proving that the activity is a hobby rather than a business or trade.

Ms. C is an elementary school teacher who decided to start a part-time business producing educational software for microcomputers. She purchased two computer systems at $2000 each, a printer for $1000, $500 in disks and paper and $500 in books and technical manuals. She also incurs expenses for obtaining a business license ($50), letterhead stationery and business cards ($100) and travel expenses ($500). She received $200 for providing tutoring in computers and $500 from the sale of a program.

The activity is conducted as a business, and during the year she incurred expenses totaling $2650 and received $700 in income for a total net loss of $1950, which may be deducted from her salary as a teacher. Note that the total cost of the computers and printer ($5000) cannot be deducted during the first year but is depreciated.

For further information regarding the tax treatment of hobby/business activities, consult sections 162, 183 and 212 of the Internal Revenue Code.

Employee Business Expenses

As an employee, you may deduct certain expenses related to the use of a computer in your job (form 2106). Materials, supplies, publications, journals, supplementary education and computer expenses can be deducted if you meet necessary requirements.

Mr. E, a programmer with Acme Software Services, is assigned to a project that involves the preparation of a financial forecasting model for an important client. The project will be due in five months. E discussed with his supervisor the possibility of having Acme lend him a computer so that he may do some of the work at home. Acme could not release their computer, but E's supervisor suggested that it would be a very good idea to do some of the work at home since it was an important job. E later purchased a microcomputer to assist him in writing the program. At the same time, he also enrolled in an economics and advanced computer programming class at a local university.

E may deduct a portion of the computer expense, computer supplies, tuition, books and materials for the classes as

(continued on page 238)

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